



RICHMOND HILL
G E O R G I A

CITY OF RICHMOND HILL

ENGINEERING DESIGN STANDARDS

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ARTICLE 1

SHORT TITLE

This Ordinance shall be known and may be cited as the Richmond Hill Engineering Design Standards (Engineering Standards).

ARTICLE 2

ENACTMENT CLAUSE

The City Council of Richmond Hill, pursuant to the authority conferred by the provisions of Article IX, Section 2, Paragraph 2 of the Constitution of Georgia of 1983, do ordain and enact into law the Engineering Standards.

ARTICLE 3

PURPOSES

The Engineering Standards are adopted for the following purposes, among others:

- (a) To Promote and protect the health, safety and welfare of the citizens of Richmond Hill; and
- (b) To establish technical standards for plats, environmental site assessments, other engineering matters and minimum guidelines for the design and construction of subdivision improvements, including but not limited to: roads, easements, pedestrian ways, and driveways, water systems, sewerage systems and drainage systems.

ARTICLE 4

DEFINITIONS OF TERMS

Section 400. Interpretation of Certain Terms or Words.

Except as specifically defined herein, all words in the Engineering Standards have the customary dictionary definitions. For the purpose of the Engineering Standards, certain words or terms used herein are defined as follows:

Words used in the present tense include the future tense. Words used in the singular include the plural, and words used in the plural include the singular. All pronouns used herein shall be deemed to include the masculine, the feminine and non-personal entities. Whenever reference is made in the Engineering Standards to another Article or Section of this Ordinance, all parts of such Article or Section are deemed to be included in such reference.

The word shall is always mandatory.

The word may is permissive.

The word person includes a firm, association, organization, partnership, trust, company, or corporation as well as an individual.

Section 401. Definitions. The definitions set forth in Section 58-3. of the subdivision regulations of Richmond Hill (Subdivision Regulations) are incorporated herein by reference and shall have the same definitions herein as set forth in the subdivision regulations.

ARTICLE 5

GENERAL

All submissions shall bear the signature and date across the seal of the engineer who prepared the plans, reports, design consideration, and calculations pertinent to the construction plans.

All construction in a City right-of-way shall require a permit and approval by the City of Richmond Hill Planning and Zoning Department.

Details are provided herein to provide specifics on construction

If a question concerning the interpretation of the Engineering Standards arises, the interpretation of the City Engineer shall govern.

The City Engineer's written approval must be obtained for any significant change in the approved construction plans prior to implementing the change in the field.

The Engineering Inspection Services letter, as shown in the sample in section 1606, shall be provided before approval is given on the construction plans as evidence that inspection services under the direction of an engineer will be provided.

The applicant's engineer shall require that one set of the approved construction plans be kept in the field and updated on a daily basis by the contractor. The applicant's engineer shall review such set of plans on a weekly basis and make a field report to the file as to the progress of the work and any changes documented which differ from the approved construction plans.

ARTICLE 6

REQUIREMENTS

Section 600. Required Improvements.

Except as otherwise provided by the subdivision regulations, a developer shall provide, install and pay for the following improvements to serve his subdivision. Utilities shall be located where possible in accordance with the proposed utility location detail.

- (1) Water Distribution; Domestic and Reuse
- (2) Sanitary Sewerage Collection;
- (3) Road Grading and Surfacing
- (4) Storm Drainage;
- (5) Road Name Signs;
- (6) Electricity;
- (7) Natural Gas (Optional);
- (8) Traffic Control Devices.
- (9) Lighting
- (10) Curb and Gutter
- (11) Telephone
- (12) Cable

Section 601. Easements.

Easements having a minimum width of fifteen (15) feet and located along the sides or rear Lot line shall be provided as required for utility lines, underground mains and cables and drainage. No fences or any other structures are allowed to be built within any easement. See sections 705 and 706 for additional requirements.

Maintenance easements shall be provided when deemed necessary by the City Engineer. Where the City Engineer determines from the preliminary plat that a drainage canal within a proposed subdivision requires mechanical cleaning, the developer of such proposed subdivision shall offer to the City an access easement on one (1) side or possibly both sides of such canal, see section 707. Such easement may be used as a location for pedestrian ways, bikeways and other amenities which do not conflict with the basic maintenance function of such easements.

Section 602. Location of Structures

602.1 Fire Apparatus Access Roads The code official listed in Fire sections shall be the Fire Chief and/or Fire Marshall.

602.1.1

Fire apparatus access roads shall be provided and maintained in accordance with Sections 602.1.2 through 602.3.4.

602.1.2 Buildings and facilities.

Approved fire apparatus access roads shall be provided for every facility, building or portion of a building hereafter constructed or moved into or within the jurisdiction. The fire apparatus access road shall comply with the requirements of this section and shall extend to within 150 feet of all portions of the facility or any portion of the exterior wall of the first story of the building as measured by an approved route around the exterior of the building or facility.

Exception:

The code official is authorized to allow a distance of more than 150 feet where:

1. The building is equipped throughout with an approved automatic sprinkler system installed in accordance with the International Fire Code.
2. Fire apparatus access roads cannot be installed due to location on property, topography, waterways, non-negotiable grades or other similar conditions, and an approved alternative means of fire protection is provided.
3. There are not more than two Group R-3 or Group U occupancies, as defined in the IFC.

602.1.3 Additional access.

The code official is authorized to require more than one fire apparatus access road based on the potential for impairment of a single road by vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

602.1.3.1 Multi-family projects having more than 100 dwelling units.

Multi-family residential projects having more than 100 dwelling units shall be equipped throughout with two separate and approved fire apparatus access roads.

Exception:

Projects having up to 200 dwelling units may have a single approved fire apparatus access road when all buildings, including nonresidential occupancies, are equipped throughout with approved automatic sprinkler systems installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the International Fire Code.

602.1.3.2 Multi-family projects having more than 200 dwelling units.

Multi-family residential projects having more than 200 dwelling units shall be provided with two separate and approved fire apparatus access roads regardless of whether they are equipped with an approved automatic sprinkler system.

602.1.3.3 One- or two-family dwelling residential developments.

Developments of one- or two-family dwellings where the number of dwelling units exceeds 30 shall be provided with separate and approved fire apparatus access roads, and shall meet the requirements of Section D104.3 of the International Fire Code.

Exceptions:

1. Where there are 30 or more dwelling units on a single public or private access way and all dwelling units are protected by approved residential sprinkler systems, access from two directions shall not be required.
2. The number of dwelling units on a single fire apparatus access road shall not be increased unless fire apparatus access roads will connect with future development, as determined by the code official.

602.1.4 High-piled storage.

Fire department vehicle access to buildings used for high-piled combustible storage shall comply with the applicable provisions of International Fire Code.

602.2 Specifications.

Fire apparatus access roads shall be installed and arranged in accordance with Sections 602.2.1 through 602.3.4.

602.2.1 Dimensions.

Fire apparatus access roads shall have an unobstructed width of not less than 20 feet (6096 mm), except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than 13 feet 6 inches. Where a fire hydrant is located on a fire apparatus access road, the minimum road width shall be 26 feet (7925 mm). Fire apparatus access roads for aerial apparatus shall have a minimum unobstructed width of 26 feet in the immediate vicinity of any building or portion of building more than 30 feet in height.

602.2.2 Authority.

The code official shall have the authority to require an increase in the minimum access widths where they are inadequate for fire or rescue operations.

602.2.3 Surface.

Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus (75,000 lbs) and shall be surfaced so as to provide all-weather driving capabilities.

602.2.4 Turning radius.

The required turning radius of a fire apparatus access road shall be determined by the code official.

602.2.5 Dead ends.

Dead-end fire apparatus access roads in excess of 150 feet in length shall be provided with an approved area for turning around fire apparatus. See Section 907(8)

602.2.6 Bridges and elevated surfaces.

Where a bridge or an elevated surface is part of a fire apparatus access road, the bridge shall be constructed and maintained in accordance with AASHTO Standard Specification for Highway Bridges. Bridges and elevated surfaces shall be designed for a live load sufficient to carry the imposed loads of fire apparatus. Vehicle load limits shall be posted at both entrances to bridges when required by the code official. Where elevated surfaces designed for emergency vehicle use are adjacent to surfaces which are not designed for such use, approved barriers, approved signs or both shall be installed and maintained when required by the code official.

602.2.7 Grade.

The grade of the fire apparatus access road shall not exceed 10 %.

602.2.8 Marking.

Where required by the code official, approved signs or other approved notices shall be provided for fire apparatus access roads to identify such roads or prohibit the obstruction thereof. Signs or notices shall be maintained in a clean and legible condition at all times and be replaced or repaired when necessary to provide adequate visibility.

602.3.1 Obstruction of fire apparatus access roads.

Fire apparatus access roads shall not be obstructed in any manner, including the parking of vehicles. The minimum widths and clearances established in Section 602.2.1 shall be maintained at all times.

602.3.2 Required gates or barricades.

The code official is authorized to require the installation and maintenance of gates or other approved barricades across fire apparatus access roads, trails or other access ways, not including public streets, alleys or highways.

602.3.3 Secured gates and barricades.

When required, gates and barricades shall be secured in an approved manner. Roads, trails and other access ways that have been closed and obstructed in the manner prescribed by Section 602.3.2 shall not be trespassed on or used unless authorized by the owner and the code official.

Exception: The restriction on use shall not apply to public officers acting within the scope of duty.

602.3.4 Security gates.

Where security gates are installed, they shall be maintained and an approved means of emergency operation shall be provided and maintained. At least one approved means of access shall be provided to each structure or other nonstructural fire hazard within the planned building group. For structures or other nonstructural fire hazards exceeding two stories or 30 ft in height above average adjacent ground level, not less than two approved separate means of access shall be provided.

Section 603 Fire Protection

603.1 Automatic Fire Protection.

Automatic fire extinguishing systems shall be required as set forth in the applicable NFPA code or standard as adopted by the Georgia Fire Commission and the City of Richmond Hill.

603.1.2 Fire Department Connections

If mounted on the building they serve, fire department connections for sprinkler systems shall be located not more than 100 ft from a fire hydrant. If such connections are located at least 40 ft from the building they serve, they shall be located not more than 50 ft from a fire hydrant. The location of the fire department connection shall be determined by the authority having jurisdiction.

603.1.3 Winterization

All fire suppression piping exposed to outdoor temperatures shall be protected from freezing.

ARTICLE 7

DRAINAGE

Section 700. Stormwater Management Standards - Riparian Rights.

The Drainage Section of this document has been developed to serve as a comprehensive guide to implementing stormwater management controls, practices and systems within the City. Additionally, this section has been updated from previous versions (June 19, 2007) to supplement the technical guidance information contained in the Georgia Stormwater Management Manual (GSMM) First Edition (August 2001), or the latest edition, and the Coastal Stormwater Supplement (CSS) to the GSMM (April 2009), or the latest edition. The latest versions of the GSMM and the CSS shall serve as the technical reference guidance for the design, construction and maintenance of stormwater management systems within the City. Any conflicts or issues that may arise pertaining to information contained in the GSMM and the CSS should be addressed at the onset of the project through correspondence with the appropriate City Staff. The City Engineer shall serve as the City Manager's primary designee regarding all technical matters as well as interpretation of applicable requirements.

- (1) It shall be the policy of the City that raising the flood water elevation on an adjacent property shall not be acceptable. A certificate from applicant's engineer stating that, to the best of his knowledge, the development of the subdivision will not increase, decrease or change the quality or quantity of surface or subsurface water reaching adjacent property shall be required. Where flood elevation(s) on an adjacent property will be increased due to development and/or construction of a drainage system, the conveyance level of service may be increased by the City in an effort to minimize impacts to the adjacent property. This requirement may be waived at the City's discretion if the adjacent property owner provides a permanent drainage easement between the two property owners. The easement shall provide that the owner of the impacted property acknowledges that an increase in flood elevations will occur on their property as a result of the proposed development. Additionally, the easement shall include at a minimum a map showing the extent of the pre-development and post-development 100-year floodplains and the party responsible for causing the impacts to the floodplain shall address any applicable FEMA or other regulatory requirements as part of the design and permitting effort. The easement must be recorded with the City as an attachment to the affected property's land deed and shall be binding on all future property owners. Long term maintenance of the easement shall be the responsibility of the private property owners in accordance with the provisions outlined in the easement.
- (2) Each subdivision shall incorporate storm water management facilities sufficient to retain or reduce pre-development peak discharge rates across adjacent property lines.
- (3) No land development or redevelopment project shall be undertaken unless the

applicant can establish to the City Engineer that the flood potential within the subdivision, on adjacent or surrounding lands or wetlands, will not be increased by the development of such subdivision. If such potential is in question, the City Engineer shall make the final determination.

- (4) Inter-basin transfer of water between river basins is prohibited.

Section 701. Planning and Submission Requirements.

- (1) Prior to submission of an application, the applicant and/or his engineer shall meet with the City Engineer to determine applicable methodology and existing known drainage conditions. Where existing known drainage problems exist, the City has the authority to require that cooperative methods be sought to resolve deficiencies.
- (2) All applications for stormwater management plan approval shall include submittals consistent with applicable sections of the City's Stormwater Management Ordinance entitled *Stormwater Management Design Procedures and Requirements*.
- (3) Drainage plans shall be designed to reduce the rear lot drainage facilities by taking advantage of natural topography as much as possible. When rear lot drainage facilities cannot be avoided, they shall be designed to accommodate maintenance.
- (4) Minimum of slope grades shall be 0.3%.
- (5) Side lot drainage shall be piped; ditches on side lot lines are not permitted. Swales (no deeper than 15") are permitted on side lot lines.

Section 702. Construction Standards

- (1) Pipe:
 - (a) Only new reinforced concrete pipe (RCP) Class III, no seconds, shall be used in City Road right-of-ways, or for Subdivision Drainage Systems, or if any storm runoff from adjoining properties drain through the proposed project.
 - (b) Driveway pipes shall be a minimum of fifteen (15) inches in diameter.
 - (c) Pipes up to thirty-six (36) inches in diameter shall have a flared end section; pipes larger than thirty-six (36) inches in diameter shall have winged head walls.
 - (d) Pipes of dissimilar size shall be vertically aligned with their energy grade line, or shall have the crowns of the pipes set at matching elevations when dissimilar size pipes converge at a manhole or other structure.

- (e) All pipe joints, in addition to the required rubber gaskets, shall be covered with approved geo-textile material of sufficient width to be secured to the pipe and completely encircle the joint with a fifty (50%) percent overlap. (See Detail D-7)
- (f) Pipes located on property lines shall have a minimum depth of cover to the finish grade of twelve (12) inches, or as specified by the manufacturer. Where such depth of cover cannot be maintained in accordance with manufacturer's specifications, the pipe shall be relocated in such a manner that the property owner will not be impaired in the construction of fences and other amenities normally located at such locations and a sufficient easement provided for the relocated position of the pipe.
- (g) Pipe gradients shall provide self-cleaning velocities without scour (2-9fps) and include energy dissipation measures where necessary.
- (h) Maximum length of pipe runs shall not exceed three hundred (300) feet. All drainage pipes shall begin and end in inlets, manholes, or end treatments.
- (i) Only RCP will be approved for drainage systems which the City will be required to maintain.
- (j) Other types of pipe may be used if approved, in writing, by the City Engineer prior to use.
- (k) All pipe that cross a road shall be bedded in suitable material, backfilled with suitable material and compacted to minimum 100% standard proctor (ASTM D698). Suitable materials are GW, GP, GM, GC, SP or SW soils as classified under the unified system. The City of Richmond Hill Inspections Dept. shall be notified twenty four (24) hours in advance of any road crossings.

(2) Curb & Ditch Inlets:

All inlets shall be of the standard design. Inlets collecting stormwater runoff from street surfaces and area inlets (e.g. catch basins, yard inlets, drop inlets, hooded grate inlets and flumes) shall be sized to capture the storm event specified for the pipe system to which it drains. Curb inlets should be located at the end of corner curve radius. Inlets that utilize the opening of the pipe as the inlet (i.e. headwalls, flared end sections, etc.) shall be sized to capture the storm event specified for the pipe system to which it drains. The headwater conditions induced by the inlet should minimize impacts to any upstream drainage structures. The designer should consult with the City Engineer during the Concept Phase to determine if any unacceptable flooding will occur and if such a

condition is acceptable/allowable. All inlets shall have inverts built in bottoms.

(3) Drainage Swales:

All channels must be protected from erosion through the use of rip-rap, concrete, erosion control matting or similar method acceptable to the City Engineer. All channel side slopes shall have a 3-foot horizontal to 1-foot vertical (3:1) slope or less, unless otherwise approved by the City Engineer. Prior to use, drainage swales shall have sufficient vegetation to provide filtration and erosion stabilization. Energy dissipation should be incorporated into the design where conditions dictate.

Swales shall have a 10:1 side slopes or flatter; however, if a swale traverses a wooded, undeveloped site, use of a 5:1 side slope may be submitted for approval by the City Engineer to reduce impact on trees. Side slopes for large ditches three (3) feet or deeper shall be 5:1. Any ditch or swale which requires less side slope will have to be approved by the City Engineer.

(4) Maintenance:

All ditch banks shall be constructed in a manner that the side slopes will not erode. Side slopes shall be 10:1 when they will be maintained with riding grass cutting equipment. The type of soil encountered will be considered in selecting the proper slope.

A Stormwater Management System Inspection and Maintenance Plan Agreement shall be executed in accordance with applicable provisions of the City's Stormwater Management Ordinance.

Section 703 Drainage Design Standards, Methodology and Criteria

(1) On-site Storm Water Control:

All applications for approval of a land development project shall provide for on-site retention or detention (dry or wet) in accordance with applicable provisions of the Stormwater Management Ordinance. The site shall be the total area of development, including non-contiguous lands if part of a non-contiguous Planned Development (PD) application, and shall be owned in fee simple or have perpetual cross easements for drainage purposes.

(2) Hydrologic Methods:

Rational Method: The rational method may be used with the approval of the City Engineer to develop peak runoff flows for culverts or stormwater drainage systems with contributing drainage areas less than 10 acres in size and for detention ponds with contributing drainage areas less than 1 acre in size. All computations shall be in accordance with Section 2.1.4 of the GSMM (Volume 2) and Section 5.0 of the CSS. Rainfall intensities shall be derived from Table A-13 (Savannah) of Appendix A of the GSMM (Volume 2).

SCS Method: The Soil Conservation Service (SCS) method must be utilized to size detention ponds with a contributing area of 1 acre or more and culverts or other drainage systems with contributing drainage areas greater than 10 acres. All computations shall be in accordance with Section 2.1.5 of the GSMM (Volume 2) and Section 5.0 of the CSS. Rainfall depths shall be derived from Table A-13 (Savannah Rainfall Data) of Appendix A of the GSMM (Volume 2), or other appropriate rainfall data reference resources.

Alternative computer models may be utilized if such computer models are approved by the City Engineer.

(3) Drainage Design Criteria:

The following design methodology and criteria shall be used for computations:

Design Storm: The design storm shall be the twenty-five (25) year frequency, twenty-four (24) hour antecedent condition II for all on-site roads, swales, culverts, drainage systems, ditches, etc. The design storm for all detention basins, retention basins, outfall structures and outfall pipes shall be the one hundred (100) year frequency twenty-four (24) hour storm event. The design engineer shall assume existing outfall ditches to be flowing full during the design storm. The new system shall be designed to prevent street flooding in accordance with Section 701 (1).

Land development plans including site grading and drainage plans should be developed to mimic natural site drainage patterns. Additionally, no increases in stormwater runoff rates shall be allowed at any discharge point from the site unless approved by the City Engineer. As a general rule, the “baseline” or pre-developed site condition shall be equivalent to a wooded undisturbed/undeveloped site regardless of whether any clearing or other development activity has occurred in the past. The City Engineer may allow for the designer to account for existing site conditions in the pre-developed analysis provided that the designer is able to present sufficient technical information to clearly support deviation from the “baseline” condition stated above. The development shall be analyzed for the 1, 10, 25, 50 and 100-year, 24-hour storm events as a minimum.

(5) General Requirements:

Pipe sizing calculations shall be checked for inlet and outlet control. Maximum headwater and tail water conditions should be provided.

If a proposed development project discharges stormwater runoff into an undersized stormwater conveyance system that is a part of the City's municipal storm sewer system (MS4), then either: (1) the post developed peak rate shall be limited to the pro-rata share of the capacity of the downstream conveyance system as established by the City Engineer; or (2) the site stormwater management plan should provide other engineering solutions that are designed to mitigate adverse impacts on the downstream conveyance system. The proposed solutions should be submitted for review and approval by the City Engineer prior to implementation.

Stormwater conveyance practices, which may include, but are not limited to, storm drain pipes, culverts, catch basins, drop inlets, junction boxes, headwalls, gutters, ditches, open channels, swales and energy dissipaters, shall be provided when necessary to convey post-construction stormwater runoff and protect private properties adjoining development sites and/or public rights-of-way. Stormwater conveyance practices that are used to convey post-construction stormwater runoff on development sites shall meet the following requirements: (1) methods used to calculate stormwater runoff rates and volumes shall be in accordance with applicable sections of the GSMM and the CSS; (2) all culverts, pipe systems and open channel flow systems shall be sized in accordance with applicable sections of the GSMM and the CSS; and (3) planning and design of stormwater conveyance practices shall be completed in accordance with applicable sections of the GSMM and the CSS.

Flood plain elevations and zones for the FEMA one hundred (100) year storm shall be shown on the construction plans.

Where FEMA flood elevation have not been determined, the design engineer shall provide such elevations based on his study and set the finish floor elevations at, or above, the new BFE (Base Flood Elevation), or the peak elevation backwater for the 100-year, 24-hour storm event within the land development project area. In the event of changes in FEMA regulations or City ordinances, the more stringent requirements will apply.

Detention and retention ponds shall be designed so that shorelines are meandering where possible to increase the length of shoreline, thus offering more space for growth of littoral vegetation for filtering purposes.

Maximum basin side slopes shall be 5:1, except where soil conditions require

flatter slopes. Where this cannot be achieved alternative designs can be approved by the City Engineer.

Wet detention basins shall be designed in accordance with Section 3.2.1.5 of the GSMM and Section 8.0 of the CSS. All wet detention basins shall have a permanent pool depth of not less than four (4) feet to reduce bottom vegetation growth.

Dry basins must be designed with access to allow for efficient maintenance of the basin bottom and side slopes.

Detention and retention ponds shall be designed to provide at least one (1) foot of vertical detention storage volume for runoff above the proposed dry weather water level design elevation.

Major drainage canals shall not be used for storage.

Use of rectangular weir outlets will be allowed only where the weir will provide better outlet control needed for a given situation than that provided by a V-notched weir. V-shaped or V-notched weir outlets are recommended to achieve detention storage. Use of innovative outlet structures such as pipe-culvert combinations, perforated riser pipes, or special graduated opening outlet control boxes, are encouraged as ways of reproducing pre-development runoff conditions.

Design data for storage volume and detention outlet requirements shall be submitted and approved by the City Engineer.

Detention and retention ponds shall be designed for ten (10) year sediment load before the one (1) foot storage volume requirement is included.

The principal outlet must convey the design peak flow without emergency overflow. Use of concrete weirs or stand pipes are preferred over undersized pipes.

Where cleared site conditions exist around detention or retention areas, the bank shall be sloped to proposed dry weather water surface elevation and planted for stabilization purposes. Where slopes are not practical or desired, other methods of bank stabilization will be used and noted on plans submitted.

Dredging, clearing, deepening, widening, straightening, stabilizing or otherwise altering natural water bodies or canals may be permitted by the City Engineer only when a positive benefit can be demonstrated. Such approval by the City does not obviate the need for State or Federal agency approvals where applicable.

Section 704. Water Quality Best Management Practices (BMPs)

The design engineer should review and consult the information contained in Section 7.0 of the CSS and the Green Growth Guidelines regarding the recommended green infrastructure practices. The design engineer is also encouraged to review and consult Section 8.0 of the CSS for guidance regarding selection of appropriate stormwater BMPs. The City Engineer may at their discretion allow proprietary stormwater management controls. Prior to specification of such a device, the designer shall consult the City Engineer to determine if the control will be acceptable.

Section 705. Drainage Easements

All drainage easements to the City must be cleared. The City shall require as a condition for obtaining approval of runoff control and drainage plans that the applicant record plats and covenants where available ensuring that drainage easements and facilities are assigned to a specific entity.

The applicant shall submit to the City Council a request for permanent dedication of drainage systems for City maintenance. The City Engineer shall certify that, to the best of his knowledge and belief, all as-built improvements so offered are in conformance with approved plans and with all prevailing City standards.

Should drainage systems and easements be deeded to homeowners or landowners association, the general maintenance requirements necessary to insure the long-term functions of storm water runoff controls, easements and drainage facilities shall be described in the documents establishing such association. The documents will also state that Richmond Hill or legal entity having authority over drainage may perform or require the homeowners or landowners association to take action under the following conditions:

- (1) If normal maintenance is not performed and is adversely affecting drainage flow.
- (2) To alleviate flooding or other drainage problems upstream or downstream of the easement.

Section 706. Underground Storm Sewer Easements

Adequate access for maintenance and improvements of the drainage facility will be required. Generally, for underground storm drain pipes the minimum width of the easement shall not be less than fifteen (15) feet. Additional width may be required based on depth of drainage structures. Sufficient width as determined by the City Engineer will be provided within the easement on one side of the pipe to allow for service equipment mobility and storage of removed fill.

Section 707. Open Channel Right-of-Ways

Open channel right-of-ways shall be sized in the table below. The open channel shall be located in the easement to provide an adequate maintenance area on each side of the open channel.

DRAINAGE RIGHT-OF-WAY SIZING TABLE

Maximum Top Width of Open Channel (feet)	Required Minimum Drainage ROW (feet)
5 - 10	30
9 - 15	35
16 - 20	40
21 - 25	55
>25	As approved by City Engineer

The maximum top width an open channel can be without access easements on both sides of open channel is twenty (20) feet. All storm drainage right-of-ways shall be reviewed by the City Engineer and upon approval recorded in the Clerk's Office and two (2) copies submitted to the Planning and Zoning Director.

Section 708. Water Surface Elevations

No subdivision will be permitted which alters the surface water elevation of any water body or Wetland in such a way as to adversely affect the natural drainage from any upstream or downstream areas of the drainage basin on a permanent basis.

The City Engineer shall review and approve any water surface elevation proposed for lagoons or water bodies. An applicant shall submit sufficient groundwater and topographic elevation data around the proposed water body site to assist in establishing the water surface elevation and area of coverage.

As a condition of drainage plan approval, the City may require that adjustments be made to existing or approved water surface elevations if upstream or downstream areas require such adjustments to provide required drainage flows.

Section 709. Exemptions From Site Runoff and Drainage Planning

- (1) Any maintenance, alteration, renewal, use or improvement to an existing Drainage System as approved by the City Engineer which does not create adverse environmental or water quality impacts and does not affect the velocity, volume or location of storm water runoff discharge; or

- (2) Work by agencies or property owners required to meet emergency flooding conditions. If possible, emergency work should be approved by the duly appointed officials in charge of emergency preparedness or emergency relief. Property owners performing emergency work will be responsible for any damage caused by their unauthorized actions. Property owners will restore the site of the emergency work to its approximate pre-emergency conditions within a period of sixty (60) days following the end of the emergency.

Section 710. Erosion and Sediment Control

Erosion and sedimentation controls shall be required on all sites in which one (1) acre or more of land surface is to be disturbed. (See the State of Georgia Manual for Erosion and Sedimentation Control for details). The Applicant must apply for a Land Disturbing Activity Permit in accordance with the requirements of the Erosion and sedimentation Act of 1975 and the Rules of the Georgia Department of Natural Resources as amended.

Section 711. Lakes, Ponds & Waterways

Artificial or natural waterways, lakes, or ponds for recreation shall not be accepted for maintenance by the City.

Waterways, lakes, ponds, detention or retention basins shall be maintained by either an established Homeowners Association or individual property owner(s). In either case, the Final Plat must indicate who will be responsible for maintenance. The City will not accept maintenance of drainage basins.

Private maintenance provisions must be made to the satisfaction of the City Engineer. The Developer is not allowed to be designated as the responsible provider of maintenance. Placing responsibility on the owner(s) of the property where the feature is located is allowed, if suitable notes and easements are provided on the Final Plat and other legal instruments.

Section 712. Stormwater Management Requirements

1. Impervious Site Coverage

No commercial, industrial, office, hotel/motel, multifamily residential, institutional use, mobile home park, will be approved which contains more than sixty-five (65) percent site coverage by impervious surfaces unless site specific soil types, percolation rates and seasonal high groundwater table conditions are adequate so as to permit a greater percent impervious coverage. Permanent on-site water surface areas will be considered as impervious material surfaces for this site coverage calculation.

The Soil Conservation Services (SCS) has identified different soil types into four (4) groups (called Hydrologic Soil Groups) according to their run-off producing characteristics. Vegetation and slope are not a consideration. These groups will be used for design ratios in accordance with the following table:

<u>Hydrologic Soil Groups</u>	<u>Impervious/Pervious Ratio</u>
A	80/20
B	70/30
C	65/35
D	50/50

Applications for projects incorporating a 65/35 ratio of impervious to pervious surface coverage do not have to submit site specific soil data; but, may rely to the general soil survey from the SCS for Bryan and Chatham Counties. Applications seeking greater than sixty-five (65) percent impervious site coverage must include site specific certified soil data, annual high groundwater table levels, soil percolation rate and supporting calculations performed by a soil expert meeting the qualifications set forth below. Soil test results submitted shall be used to determine the allowable surface coverage ratio in accordance with the table set forth herein.

Section 713. Drainage Details.

(1)	Plan Curb Inlet	D-1
(2)	Curb Inlet, Section A-A	D-2
(3)	Curb Inlet, Section B-B	D-3
(4)	Frame and Cover	D-4
(5)	Ditch Inlet	D-5
(6)	Roof Inlet	D-6
(7)	Pipe Joint	D-7

ARTICLE 8

PAVEMENT DESIGN

Where curb and gutter is a part of the road design;

Storm water carried in the gutter shall not over top the curb; and

Storm water shall not rise on the paved surface to obscure the centerline and a width of one (1) foot each side of the centerline of the roadway maintained.

Asphalt wearing surface shall be a minimum of one and one half (1 ½) inch thick, hot plant mix, type “E” or “F” when an asphalt leveling course is not used, or a minimum of (1) inch thick when asphalt leveling course is used.

Asphalt leveling course shall comply with all provisions of the Georgia Department of Transportation criteria for material and placement.

Pavement bases shall be a minimum six (6) inches Graded Aggregate compacted to 100% standard density.

Remove all existing material a minimum of twenty four (24) inches below the proposed roadway base material or provide soil boring test results from a certified laboratory, recognized by the City of Richmond Hill, stating that the sub base material is suitable for road construction.

Suitable materials are those complying with ASTM D-2487 soil classification groups: GW, GP, GM, SP and SW soils as classified under the unified system.

Sub-base shall be a minimum of twenty four (24) inches of granular material compacted to a one hundred (100%) percent standard proctor density. Additional lifts below the first twenty four (24) inches shall be compacted to a ninety-five (95%) percent standard proctor density or greater. All roads shall be proof rolled and witnessed by representative of the City Inspections Department prior to the base material being placed. All unsuitable material shall be removed and replaced with acceptable material.

Sanitary and storm sewer asbuilt invert elevations must be certified by the Design Engineer and accepted by the City of Richmond Hill Inspections Department before any asphalt paving can be applied. See sample invert certification letter Section 802.

A liquid asphalt tack coat must be applied before overlaying existing asphalt or concrete paving. Tack coat shall be applied per GADOT specifications.

Section 800 Residential and Local Road Design

Minimum centerline pavement grade shall be 0.30%.

Maximum centerline pavement grade shall be 10%.

Minimum road elevation shall be 9.0 feet MSL NAVD 1929. (Pavement and Gutter)

The road way cross slope shall be 3/8 in per foot.

Maximum road design speed - thirty (30) mph.

Minimum sight distance - two hundred (200) feet.

Minimum centerline radius of curve - one hundred (100) feet.

Minimum tangent between reverse curves - fifty (50) feet. This may be reduced to zero (0) feet with the approval of the City Engineer.

Section 801 Curb and Gutter

Curb and gutter shall be constructed with Portland Cement Concrete having a twenty-eight (28) day strength of three thousand (3,000) psi. Slip form or machine curb and gutter shall have expansion material minimum of one-half (2) inch thick with a maximum spacing of one hundred (100) feet and abut a solid structure where one (1) day's pour abuts a previous day's pour. Construction joints 1/4 - 1/3 the depth of the gutter shall be sawed or tooled at a maximum spacing of twenty (20) linear feet.

Concrete gutters shall be 12", wide; and combined curb and gutters shall be 18", unless otherwise approved by the City Engineer. Exceptions to the above are Georgia DOT right of ways.

Where roadside ditches are permitted and pedestrian ways are provided, crosswalks shall be provided when road lengths exceed six hundred (600) feet. Crosswalks should have a minimal interval of five hundred (500) feet. This interval may be modified based on design of subdivision road layout, block length, design speed, etc. The ditch or ditches on both sides of the road shall be piped and the pipe covered with compacted fill. A concrete six (6) foot wide Pedestrian Way shall be provided across the ditch and shall connect the pavement to the proposed pedestrian way in the subdivision. The Road shall be marked with reflector paint and striped. The speed limit shall be reduced to fifteen (15 MPH) miles per hour.

Residential Curb and gutter shall have a minimum gutter thickness of six (6) inches.

Commercial curb and gutter shall have a minimum gutter thickness of eight (8) inches and shall be thicker as required by its location, soil conditions and traffic load.

Section 802 Paving Details

(1) Typical Standard Local Road PD-1

(2) Sample sanitary and storm sewer invert
asbuilt elevation certification letter. PD-2

ARTICLE 9

ROAD STANDARDS

For the purpose of these Engineering Standards, Roads shall be defined based on the number of vehicle trips per day as follows:

<u>Classification</u>	<u>Vehicles per day (vpd)</u>
Major Through fares	1501+ & Moves traffic through County
Arterial	1500+
Collector	401 -1500
Local	0 - 400

Utility installation (electrical, telephone, cable television and gas) are encouraged to be placed underground in all new Subdivisions, except where overhead service can be provided to adjoining properties without the addition of new poles.

See Detail for preferred locations of underground utilities and services.

Road standards not specifically addressed or where conditions warrant, the design shall conform to the standards of practice in TRAFFIC ENGINEERING HANDBOOK, Institute of Transportation Engineers, latest edition.

Section 900 Roads

(1) Sight Distance:

No fence, wall, tree, terrace, building, sign, shrubbery, hedge, other planting or structure or object capable of obstructing driver vision will be allowed at intersections.

(2) Clear Right-of-way:

Except as otherwise provided herein, it shall be required that the right-of-way be cleared, all surface improvements removed from the right-of -way, and all sub-surface improvements parallel to the pavement be relocated from under the pavement. All areas disturbed during construction and shoulders and slopes shall be seeded to obtain permanent vegetation for controlling erosion.

(3) Clear Zone:

The maximum possible clear zone within the proposed right-of-way shall be provided. Guardrails shall be provided if obstructions cannot be eliminated. Also, guardrails shall be provided at bridge ends, along slopes steeper than 4:1 exceeding ten (10) feet

height, and at other hazardous locations.

(4) Roadside Parking:

All Roads shall be considered to provide road-side parking unless plans clearly state that road-side parking will be prohibited. Where road-side parking is prohibited, the Applicant shall provide for No Parking signage as part of the design. Where road-side parking is provided, a nine (9) foot wide paved surface will provide for each lane.

(5) Roadside Shoulders:

Except as otherwise provided herein, roadside shoulders shall be a minimum of eight (8) feet wide for arterial roads and collector roads and six and one half (6 ½) feet for local roads, except where road-side parking is permitted.

(6) Road Drainage:

The roadway drainage shall be adequate with sufficient outfall so that roads will not become impassable during heavy rainfall events.

(7) Roadside Sub Grade Drains:

Parallel roadside sub-drains shall be a six (6) inch diameter perforated pipe surrounded with graded aggregate, surrounded with an approved geo-textile material in a twenty-four (24) inch wide trench with a minimum of two (2) foot depth or six (6) inch diameter perforated pipe with sock, surrounded with coarse sand (no fines). Both alternates shall have 14 gauge copper tracer wire. See detail herein.

(8) Roadside Signs:

All signs, structures, and appurtenance located within the shoulder shall be of break-away construction.

(9) Access to Adjacent Property:

Each Road must connect to an existing Public Road or an Approved Private Road System. The Road must not possess any unusual features that will cause the construction or maintenance cost to be normal.

The proposed road layout shall be coordinated with the road system of the surrounding area. Where possible, existing roads shall be extended.

(10) Roads Located on Dams:

If a road is located on a dam, the dam must be declared safe in accordance with the

Dams and Reservoirs Safety Act.

(11) Reserved Strips Prohibited:

A road intended to be dedicated to the City shall not be located so that a narrow buffer strip is maintained between the right-of way of such road and adjacent property in such a manner as to deny access to another adjacent property.

(12) Access to Arterial Roads:

No residential road, driveway, or other access point shall enter an arterial road at a point nearer than five hundred (500) feet from an existing highway, road, driveway, or other access point; except, where an existing lot of record would be rendered unusable by the strict application of this provision.

(13) Roadside Ditches:

Roadside ditches over three (3) feet deep shall be piped, and a parallel sub-drain system shall be provided as deemed appropriate by the City Engineer.

Section 901 Property Access

- (1) Permits for all driveways, curb cuts and roadside culverts shall be obtained from the City of Richmond Hill Planning and Zoning Department.
- (2) Installation of new driveways on curb and gutter roads must conform with the driveway curb cut detail herein.
- (3) No new driveway shall be constructed on top of sanitary sewer or water lateral connections.

Section 902 Curb-Cut Location and Design

Where the lowering or cutting away of curbs, or the placement of driveway pipe and/or asphalt on non-curb sections is required for the purpose of ingress and egress to a lot or subdivision, such work shall be subject to the following provisions: The City Engineer may require submission and review of an access plan. Access to each parcel in PD Developments and commercial/industrial properties shall be reviewed during construction plan review.

(1) Residential Curb Cuts:

(a) No more than two (2) combined entrances and exits shall be allowed for any lot, having a frontage less than two hundred (200) feet on any one local road. Additional entrances or exits for Lots having a frontage in excess of two (200) feet may be permitted at the rate of one (1) entrance/exit for each additional one hundred (100) feet of frontage.

(b) For local road intersections (corner lots), no curb cuts shall be located within twenty-five (25) feet of the intersection of two (2) curb lines or such lines intended, or within fifteen (15) feet of the end of curb radius, whichever is more restrictive. On collector roads, no driveway shall be within seventy (70) feet of the intersection of two curb lines or curb lines extended or fifty-five (55) feet of the intersection of the two (2) right-of-way lines, or within fifty (50) feet of the end of curb radius.

(c) The distance between any two curb cuts on the same side of the roads shall not be less than ten (10) feet on local roads and twenty-five (25) feet on collector roads. Said distance shall be measured between the points of tangency of the curb return radii.

(d) The width of the driveway shall not exceed twenty (20) feet at the right-of-way line and twenty four (24) feet at the edge of the pavement.

(e) Curb cuts for abandoned sites, or where access is obstructed due to parking lots, buildings, or other permitted structures, the old driveway shall be removed, the sidewalk (if existing) shall be replaced, the curb and gutter shall be replaced, fill dirt backfilled to its natural state and grassed; where it is a piped drive to a dirt or paved road, said pipe shall be removed, asphalt removed, and the shoulders and ditch re-graded to its previous state.

(2) Commercial & Multi-Family Curb Cuts:

Commercial and Multi-family curb cuts shall be installed by the property owner in accordance with the approved plans by the City Engineer.

(a) No more than two (2) combined entrances and exits shall be allowed for any parcel where the frontage is less than three hundred (300) feet on any one (1) road. On parcels with less than one hundred-fifty (150) feet of frontage, only one (2) combined entrance and exit shall be allowed (two one-way driveways shall be allowed in lieu of the one two-way). Additional entrances or exits for parcels of property having frontages in excess of three hundred (300) feet may be permitted at the rate of one entrance/exit for each additional one hundred-fifty (150) feet of frontage.

(b) For local road intersections (corner lots), no curb cuts shall be located within twenty-five (25) feet of the intersection of two (2) curb lines or such lines extended, or within fifteen (15) feet of the intersection of two (2) right-of-way lines or such lines extended, or within fifteen (15) feet of the end of curb radius, whichever is more restrictive. On Collector Roads, no driveway shall be within seventy (70) feet of the intersection of two curb lines or curb line extended or fifty-five (55) feet of the intersection of the two (2) right-of-way lines, or within fifty (50) feet of the end of curb radius.

(c) The distance between any two (2) curb cuts on the same side of a Road shall be not less than twenty-five (25) feet on Local Roads and twenty-five (25) feet on Collector Roads. Said distance shall be measured between the points of tangency of the curb return radii.

(d) All driveways shall be constructed so as to be at least twelve and one-half (12.5) feet radius for multi-family and at least twenty-five (25) feet radius for commercial development.

(e) Maximum width of any driveway shall not exceed thirty-five (35) feet measured at the end of the radii; minimum of twelve and one-half (12.5) feet radius.

(f) Curb cuts for abandoned sites, or where access is obstructed due to parking lots, buildings, or other permitted structures, the old driveway shall be removed, the sidewalk (if existing) shall be replaced, the curb and gutter shall be replaced, fill dirt backfilled to its natural state and grassed; where it is a piped driveway to a dirt or paved road, said pipe shall be removed, asphalt removed and the shoulders and ditch regraded to its previous state.

Section 903 Roads Within Subdivisions

Except as otherwise provided herein, roads within subdivisions shall have a standard road width of twenty-seven (27) feet back to back with curb and gutter and a shoulder width of six and one-half (6.5) feet. When roadside swales or ditches are permitted, the road width shall be twenty-four (24) feet wide with a six and one-half (6.5) foot shoulder or greater.

Section 904 Dead-end Roadways and Cul-de-sacs

All cul-de-sacs regardless of street length will have a diameter of no less than 100-ft of traveled way, unless otherwise approved by the City Engineer. All temporary dead end roadways shall have a temporary turnaround constructed of four (4) inches graded aggregate with a diameter of no less than 100 ft. of traveled way.

Section 905 Parking Lots

The minimum lengths of parking lot stalls as measured from the end of the stall and the minimum aisle widths shall be as shown in Table 905.1

Table 905.1 Parking Lot Stall Dimensions

Minimum Stall Lengths	Minimum Aisle Width (one-way traffic flow)	Minimum Aisle Width (two-way traffic flow)
27.5 ft for 45 degree parking	20 ft	24 ft
23.7 ft for 60 degree parking	20 ft	24 ft
20.9 ft for 75 degree parking	24 ft	24 ft
20.0 ft for 90 degree parking	24 ft	24 ft

Parking lot lanes adjacent to any building shall provide a travel lane with 20 ft clear width if traffic flow is one-way and 24 ft clear width if traffic flow is two-way.

The minimum turning radius for parking lot lanes necessary for fire department apparatus access shall be determined by the authority having jurisdiction.

Section 906 Traffic Control Plan

An applicant shall furnish a traffic control plan for all subdivisions involving public or private right-of-way for review and approval. This requirement applies to all subdivisions which increase the traffic count and/or have an impact on traffic routing. Traffic counts shall be determine to be equal to five (5) vehicles per day (vpd) per lot. Other counts will be accepted that are in conformance with the most currant edition of the Institute of Transportation Engineer's Trip Generation Manuel (ITE Manuel).

The traffic control plan shall indicate all traffic control/warning signs and devices required for the safe and orderly flow of traffic. This plan shall include, but not be limited to, signs such as: NO PARKING, STOP, DEAD END, SPEED LIMIT, SLOW-CHILDREN PLAYING, YIELD, PEDESTRIAN CROSSING, ROAD NAME, and PAVEMENT STRIPING.

An applicant shall also be responsible for any changes or additions required in the road from which access to the subdivision is authorized. The City Engineer may require additional information and traffic engineering studies to determine impact on the neighboring road system by the proposed subdivision. The improvements to the neighboring road system that may be required include turn lanes, passing lanes, acceleration lanes, deceleration lanes, by-pass lanes, signs, pavement markings, etc.

All traffic control signs, devices, and striping shall conform with the Manual for Uniform control Devices (MUTCD) latest edition. All traffic control and warning signs shall be of engineering grade reflectorized quality, made on extruded aluminum sign blanks and mounted on galvanized u-channel posts. All installations shall be compatible with the standards used by the City's Engineering and Inspections Department. All incidental hardware for signage shall meet or exceed specifications of the Georgia Department of Transportation.

Section 907 Road Details

(1)	Preferred Utility Location	P-1
(2)	Driveway Detail	P-2
(3)	Curb and Gutter Details	P-3
(4)	Subdivision Entrance – Undivided	P-4
(5)	Subdivision Entrance - Divided	P-5
(6)	Curb Cuts	P-6
(7)	Cul-De-Sac	P-7
(8)	Bituminous Replacement	P-8
(9)	Roadside Sub-grade Drain	P-9

ARTICLE 10

PEDESTRIAN WAYS

Section 1000 General

When required in the subdivision regulations, pedestrian ways shall be shown on the construction plans, which shall indicate the location of pedestrian ways and provide the typical pedestrian way detail.

(1) Pedestrian ways situated within dedicated rights-of-way:

(a) Residential Subdivisions:

- (i) The location of the Pedestrian Ways shall be placed one (1) foot inside the right-of-way or as otherwise approved by the City Engineer and in a logical terminus and with wheelchair access.
- (ii) Pedestrian Ways shall be four (4) feet wide, four (4) inches thick, broom-finished, Portland cement concrete with a minimum twenty-eight (28) day strength of 2,500 psi. The slope shall not be less than $\frac{1}{4}$ " per foot.

(b) Non-Residential Subdivisions:

- (i) Pedestrian Ways shall be a minimum of six (6) feet wide and shall have minimum thickness of four (4) inches, broom-finished, Portland cement with a minimum twenty-eight (28) day strength of 2,500 psi. The slope shall not be less than $\frac{1}{4}$ " per foot. Thickness of commercial sidewalks shall be determined by applicant's engineer to accommodate the use at the location of the feature.

(c) Multi-family, Parks, Recreational areas, or Campus:

- (i) Pedestrian Ways in areas other than residential and commercial shall have a minimum width of eight (8) feet or wider to accommodate the requirements of the facility and serve the purpose intended, and shall meet all other requirements of non-residential Pedestrian Ways.

(2) Pedestrian Ways not situated within dedicated Rights-of-Way:

- (a) Any such pedestrian way shall be restricted as part of a subdivision common open space when on a residential site; on a non-residential site, a permanent easement shall be reserved and maintenance assigned to a specific entity. In any event, the City Engineer must approve the Plan for ownership and Maintenance of Pedestrian Ways. The Pedestrian Way may be counted toward the requirement in the Subdivision Regulations for Recreation Tracts.
- (b) Choice of surface materials include concrete, bituminous mixes, soil cement, stabilized earth, treated wood planking, and pavers, and shall depend upon use and users of the Pedestrian Way and its relationship to other amenities. Other material may be approved by the City Engineer depending on the location and ability to be relatively maintenance free.
- (c) Pedestrian Ways may be sized on the probable volume of pedestrian traffic, and in consideration of the site's location with respect to Recreation Tracts, parks, schools, and commercial areas. Pedestrian Ways shall be a minimum of eight (8) feet wide.

Section 1001 Bikeways and Bicycle Lanes

- (a) If provided by the Applicant, bikeways may be sized on the probable volume of bicycle traffic, and in consideration of the site's location in relation to other populated area or its locations with respect to an overall bike route plan adopted by the Planning Commission. Bikeways should be separated from motor vehicle and pedestrian traffic as much as possible. Bikeways shall be minimum of eight (8) feet paved width provided for two (2) way bicycle traffic.
- (b) If provided by the applicant, bicycle lanes shall be at least four (4) feet wide, or wide enough to allow safe passage of bicycles and motorists. Bicycle lanes are not allowable on arterial roads.

Section 1002 Pedestrian Way Detail

PW-1

ARTICLE 11

WATER SYSTEMS

Section 1100 Water Supply and Distribution

General

- (a) Manholes, pits, or vaults containing valves, blow-offs, meters, pressure reducing valves, or other appurtenances in the distribution system shall drain to the surface of the ground where they are not subject to flooding by surface water, or to absorption pits underground. Under no circumstances are such to be connected to storm or sanitary sewer systems.
- (b) Water mains shall be laid at least ten feet (10) horizontally from any existing or proposed sewer.
- (c) Where water mains and sewer cannot be laid to the above standard, the mains shall be laid to conform with the Georgia Environmental Protection Division's Rules and Regulations and as a minimum shall comply with the Recommended Standards for Water Works as promulgated in the "A Ten State Standards".
- (d) All water mains that service fire hydrants shall have a minimum diameter of eight (8) inches.
- (e) Dead end water mains that exceed 300 feet in length will be a minimum of eight (8) inches in diameter. Dead end water mains that exceed 600 feet in length will be a minimum of ten (10) inches in diameter. Exception: Where plans can be shown for future development that will continue the water main to tie to an existing water main.
- (f) New water main shall be extended across proposed project to furthest property line.
- (g) Loop new mains to existing mains six (6) inch or larger if within 300 feet of existing system. If water main is extended the City will assist in easement acquisition, if needed.
- (h) All water lines that cross a road shall be bedded and backfilled with suitable material, see Article 8 Pavement Design for suitable material specs. The City of Richmond Hill Inspections Department shall be notified twenty four (24) hours in advance of any road crossings.

- (i) The City of Richmond Hill Inspections Department shall be notified twenty four (24) hours in advance of any taps into existing water mains.
- (j) Street sub grades and right of way grades shall be within two tenths (.20) of finish grade before any utilities are installed. Utility installation shall not occur until the City's Inspection Department has approved the rough grade of the streets and right of ways.
- (k) Service connections shall consist of a tap to the water main with a stainless steel tapping saddle.
- (l) Mega lock systems or equivalent restraints can be used in place of thrust blocking when approved by the City Engineer.
- (m) Landscape irrigation lines and heads shall not be located within ten (10) feet of the back of curb or edge of pavement.
- (n) Water supply systems not publicly owned and installed shall meet the minimum city requirements of NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, where no recognized water supply distribution exists.
- (o) Where other fire-fighting water supply systems are established by the authority having jurisdiction, they shall not be less than the requirements of NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting.
- (p) The water supply system shall be capable of delivering the required fire flow at a minimum twenty (20) PSI. For all other required fire flows, the water supply system shall be capable of delivering the required fire flow for at least 1 hour at 20 PSI.
- (q) Air Release Valves: Air release valves or hydrants shall be required at all high points in the water distribution system. Automatic air release valves shall not be use in situations where flooding of the manhole or chamber may occur.
- (r) All connections to existing water mains shall be made in the presence of the City of Richmond Hill Inspections Department.
- (s) The contractor shall furnish and install the tapping sleeves and valves to existing water mains.

- (t) The contractor shall pressure test the tapping sleeve and valve installation in the presence of the City of Richmond Hill Inspections Department. The test pressure shall be 150 psi. This shall be held for ten minutes at zero pressure loss.
- (u) Valves on existing mains shall be operated by the City of Richmond Hill or under their direct supervision.
- (v) When service must be interrupted to existing customers during construction of a tap or addition of appurtenances: The contractor shall provide 3 days notice to the City of Richmond Hill Inspection Department. The contractor or developer shall be required to notify existing customers as directed by the City of Richmond Hill. The contractor shall be ready to proceed with as much material preassembled as possible at the site to minimize the length of service interruption. The City of Richmond Hill will postpone a service cut-off if the contractor is not ready to proceed on schedule.

Section 1101 Water Crossings

- (a) Underwater Crossings: A minimum cover of four (4) feet shall be provided over the pipe. When crossing water courses which are greater than fifteen (15) feet in width, the following shall be provided:
 - (i) The pipe shall be Ductile Iron. The City Engineer can approve an acceptable alternative design.
 - (ii) Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valve shall be easily accessible and not subject to flooding. The valves shall be installed in a manhole or vault.
 - (iii) Permanent taps shall be made on each side of the valve on the source side to allow insertion of small meter to determine leakage and for sampling purposes.
- (b) Above-water Crossings: The pipe shall be adequately supported and anchored, protected from damage, freezing, accessible for repair and with expansion and contractions joints.

Section 1102 Service Connections.

Any time a Water System is installed in a Subdivision, water services shall be provided to each lot and shall extend 18" to 24" above ground at the right of way. Service connections shall consist of a tap to the water main, using a stainless steel tapping saddle, one (1) inch corporation stop, one (1) inch iron pipe size polyethylene or polybutylene tubing, and one (1) inch curb stop. Taps to mains shall be at a 90 angle. Service lines shall have a minimum of twenty-four (24) inch cover. Measurements to the service lines must appear in the record drawings. Where curb and gutter is placed, the curb shall be marked with a "W" engraved 1/4" into the curb to locate the water service lateral. Laterals shall be installed parallel with the side lot line of the property. Lateral shall not be further than five (5) feet away from the side property line. Lot widths greater than sixty (60) feet can have laterals installed to the middle of each lot.

Section 1103 System Structures Location.

- (1) Water lines shall be designed to minimize pavement crossings to the greatest degree practical.
- (2) Valve boxes, manholes, and other appurtenances shall not be located in the paved portion of the right-of-way unless approved by the City Engineer.
- (3) Fire Hydrants, valve boxes, manholes and other structures shall be located at adjoining property lines, if possible.
- (4) Fire hydrants located in parking areas shall be protected by barriers that will prevent physical damage from vehicles without obstructing hydrant operation.
- (5) Fire hydrants shall be located within 6 ft of the curb line of the means of access unless the authority having jurisdiction determines another location is more acceptable for fire department use.
- (6) Water services shall be shown on the construction plans and referenced to structures or other identifiable objects of permanence.
- (7) Depth of the water lines and services shall have a minimum depth of bury of thirty-six (36) inches and a maximum cover of 48" unless otherwise previously approved by the City Engineer. Where this can not be obtained under swales or ditches, the line shall be ductile iron pipe or encased in concrete the width of the swale or ditch. See detail for storm drain crossings.
- (8) No laterals shall be installed under existing or proposed driveways.

(9) During Construction Phase

- (a) When the infrastructure is being installed, and prior to the location and construction of buildings or portions thereof, the water supply for fire protection, either temporary or permanent and acceptable to the authority having jurisdiction, shall be made available prior to delivery of combustible materials.
- (b) When the infrastructure is being installed, and prior to the location and construction of buildings or portions thereof, fire hydrants shall be installed at a spacing not to exceed 660 ft of vehicle travel distance. Where buildings are proposed, the authority having jurisdiction shall require additional hydrants and closer spacing where building size, use, construction, and lack of built-in fire protection mandate.

(10) Prior to the construction of buildings or portions thereof:

At this time, the authority having jurisdiction shall review the fire flow required and designate spacing of hydrants according to the following schedule:

- (a) There shall be at least one hydrant within 330 ft of any building, at a location acceptable to the authority having jurisdiction.
- (b) No portion of the exterior walls of a commercial building shall be more than 200 ft from a hydrant, where vehicular access into the building is provided.
- (c) Additional hydrants shall be provided to meet the remaining fire flow, if necessary.
- (d) In areas of one- and two-family dwellings, hydrants shall be located a maximum of 660 ft vehicle travel distance apart.

Exception: Where conditions are such that items (a) through (d) are impractical to achieve, the authority having jurisdiction shall consider reasonable substitutions meeting the intent of this section, provided adequate fire protection is maintained.

Section 1104 Water Materials.

All water materials shall meet the following specifications, except where the system is an extension of an existing public water system. Where extensions to public water systems are proposed, the owner of the system shall approve the extensions and concur with the proposed location and design. A letter from the owner of the system stating the above is required.

Lead Content: Any pipe, valve meter, appurtenance, solder or flux used shall be lead free. Lead Free is defined as less than 0.2 percent lead in solder or flux and less than 8.0 percent lead in pipes and fittings.

(1) Pipe:

All pipe shall be marked as to Type, Class or normal thickness, weight, manufacturer, and date of production. Pipe not properly marked shall be unacceptable and removed from the job. All PVC water main pipe shall be blue in color.

- (a) Ductile Iron Pipe (DIP): DIP shall conform to the requirements of ANSI Specification A21.51 (AWWA C-151) latest revision. The pipe shall be designed for the actual cover installed over the pipe. Joints shall be push-on which conform to the requirements of ANSI Specifications A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specifications A21.10. Joints for fittings shall be mechanical joints conforming to the requirements of ANSI Specifications A21.11. All ductile iron pipe and fittings shall have a cement-mortar lining of 45 mils thickness minimum conforming to the requirements of ANSI Specifications A21.4 Ductile iron fittings are required regardless of the type of pipe on three (3) inch size and larger. All fittings shall be American made.
- (b) Poly Vinyl Chloride (PVC): PVC pipe and joints shall conform to all requirements of the AWWA/ASTM Specifications D-2241 and shall be C-900. Joints shall be push-on type utilizing synthetic rubber ring gaskets conforming to the requirements of AWWA/ASTM Specifications D-1869. Pipe shall bear the National Sanitation Foundation (NSF) seal of approval. PVC fittings may be used only on pipe smaller than three (3) inches in size.

- (c) Polyethylene Pipe: Polyethylene pipe (service connection pipes) shall conform to the requirements of AWWA/ASTM D-2239 - SDR11.5 and shall be IPS PE 3408 pipe. The pipe shall be designed for 200 psi and shall bear the National Sanitation Foundation (NSF) seal of approval. The joints shall be push-on type utilizing synthetic rubber ring gasket conforming to the requirements of AWWA/ASTM Specification D-1869. The service connection pipes shall be blue or black in color.
- (d) Irrigation pipe: Purple Poly Vinyl Chloride (PVC): Purple PVC pipe and joints shall conform to all requirements of the AWWA/ASTM Specifications D-2241 and shall be C-900 DR18.

(2) Valves:

Gate valves shall be used for all sizes two (2) inches through twelve (12) inches in the main distribution line. Butterfly valves shall be used where the diameter exceeds twelve (12) inches or if determined necessary by the City Engineer. All valves shall open counter clockwise. All butterfly valves shall have a 450 foot lbs. actuator minimum. All valves shall have a cast iron screw type valve box and a four (4) inch thick concrete collar. All valves are to be designed for a minimum working pressure of not less than 150 psi.

- (a) Butterfly valves shall be the resilient seated type which meets the requirements of AWWA/ASTM Specification C504.
- (b) Main line gate valves shall be the resilient seated iron body type which meets the requirements of AWWA/ASTM Specification C-509. Unless otherwise specified, gate valves shall be designed for a working pressure of not less than 150 PSI.

(3) Marking Tape:

All PVC water mains and service lateral installations shall include the installations of a continuous magnetically detectable tape buried directly over the pipe at a depth of twelve (12) inches below the finish grade. The tape shall be at least two (2) inches wide, and be boldly labeled every eighteen to thirty-two (18-32) inches as follows: CAUTION WATER LINE BURIED BELOW. The tape shall be designed to last as long as the pipe it is installed over, even in adverse soils.

(4) Tracer Wire:

#14 gauge copper tracing wire shall be strapped to pipe and extended to top of

all valves, fire hydrants, laterals, etc. for ease of connection. Splicing shall be water tight connection.

(5) Fire Hydrants

Fire hydrants shall open clockwise, have a 4-1/2 inch main valve, three (3) way hose connection including a 4 ½ in steamer connection w/NST threads, and be painted Federal Safety Yellow. Hydrants shall be ordered from the supplier painted yellow when possible.

Threads on fire hydrant outlets shall be American National Fire Hose Connection Screw Threads and shall be equipped with thread adapters where local fire department thread is different.

Fire hydrants shall be supplied by not less than a eight (8) inch diameter main.

Section 1105 Hydrostatic Tests

Hydrostatic tests shall consist of two (2) parts; pressure test and leakage test at which a representative of the City's Inspections Department shall be present. These tests shall be supervised by the Applicant's Engineer. Before conducting hydrostatic test, flush pipes with water to remove dirt and debris. Maintain flushing velocity of at least 3 fps. Flush pipes for the minimum time period as given by the formula below and as required to thoroughly clear the pipeline of dirt and debris.

$$T = \frac{2L}{3}$$

Where: T = flushing time (seconds)
L = pipe length (feet)

(1) Pressure Test:

Prior to any pressure testing, the Contractor must clean out and flush the line of dirt and foreign material. After the water mains and lines have been laid or erected and the necessary anchors installed, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure not less than fifty (50%) percent above the normal operating pressure, but not less than 150 PSI and not greater than the pressure rating of the pipe.

Test pressure shall be based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.

All valves shall be completely opened and closed several times during the test period.

If permanent automatic air release valves are not located at all high points, brass

corporation stops shall be installed and shall remain as part of the work. All air shall be vented from the main prior to testing.

(2) Leakage Test:

After the water system pressure test has been completed satisfactorily, the leakage test shall be conducted in conformance with AWWA C-600.

The duration of each test shall be two (2) hours at a pressure of 150 PSI.

No installation shall be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = SD \sqrt{P / 133,200}; \text{ where:}$$

L = Allowable leakage in gallons per hour

S = Length of pipeline tested in feet

D = Diameter of pipe in inches

P = Average test pressure in PSIG

Exceptions: All visible leaks shall be corrected regardless of the amount of leakage. Whenever the pressure loss falls 5 PSI or more in 2 hours, a retest is required.

(3) Sterilization:

All new, cleaned, repaired or affected water mains shall be disinfected in accordance with AWWA C601. Water main sterilization samples shall be taken by and administered by a certified lab. Test results must be submitted to the City's Inspection Department for approval before any connection can be made to the City's water system. A double check valve and back flow preventor must be used to connect new water system with existing water system until new water system has been inspected, sterilized and accepted by the City's Inspection Department. After final approvals, connections shall be made to existing system within two (2) weeks. Otherwise additional testing will be required.

Section 1106 Water Details.

(1)	Reaction Block Detail	W - 1
(2)	Fire Hydrant	W - 2
(3)	Valve Box Detail	W - 3
(4)	Waterline Encasement	W - 4
(5)	Blow-Off Detail	W - 5
(6)	Waterline Termination	W - 6
(7)	Standard ¾" or 1" Meter Service Tap	W - 7
(8)	Water/Sanitary Sewer Separation	W - 8
(9)	Storm Sewer Crossing	W - 9
(10)	Lateral Location	W - 10
(11)	¾" & 1" Res. Double Check Valve and Meter Assembly	W -11
(12)	Fire Service System Layout Plan	W -12
(13)	Reduced Pressure Assembly for Fire System	W-13
(14)	Double Check Valve Assembly for Fire System	W-14
(15)	5/8"-1 ½" Double Check Valve & Meter Assemblies	W-15
(16)	3"-10" Double Check Valve & Meter Assemblies	W-16
(17)	Reduced Pressure Zone Device	W-17
(18)	Tapping Saddle	W-18
(19)	Fire Hydrant Guard Post	W-19
(20)	Manifold for Multiple Meters	W-20
(21)	Post Hydrant	W-21

ARTICLE 12

SEWERAGE SYSTEMS

Section 1200 General

- (1) Any Private Sewerage Systems providing service to two (2) or more Units must be approved by the City Engineer.
- (2) Sewer mains shall be designed to minimize pavement crossings to the greatest degree practical.
- (3) Manholes shall not be located in the paved portion of the right-of-way and shall be located in relation to adjacent property lines when possible.
- (4) Horizontal separation between water and sewer shall be in accordance with EPD-DNR.
- (5) The minimum horizontal separation between the edge of the pavement and the sewer main shall be ten (10) feet in sixty (60) foot right-of-ways, except on a curve a five (5) foot separation shall be maintained.
- (6) Sewer laterals shall be installed to the property line of each lot and its location shall be shown on the construction plans for the subdivision. Each lateral shall provide a 45 degree bend and extend three (3) feet above ground with a pvc cap. Sewer laterals shall be located at the lot property line and within five (5) feet of the side lot line. No laterals shall be installed under existing or proposed driveways. Measurements to the sewer lateral must appear in the construction plans. Where curb and gutter are placed a "S" shall be stamped into the curb a $\frac{1}{4}$ " so that the lateral can be located in the future. Lots with widths greater than sixty (60) feet can have laterals installed to the middle of the lot.
- (7) The sewer lateral shall have a minimum depth of bury of thirty-six (36) inches and shall have a minimum of twenty-four (24) inches of cover at the invert of Roadside swales and ditches. Where this can not be obtained, the lateral shall be ductile iron pipe or encased in concrete the width of swale or ditch.
- (8) All sanitary sewer pipe shall be bedded in rock, to the spring line, if the trench is wet or sand if the trench is dry and covered with a minimum of twelve (12) inches of sand.
- (9) All sanitary sewer that crosses a road shall be completely covered in suitable material. See Article 8 pavement design for suitable material.

- (10) The City of Richmond Hill Inspections Department shall be notified twenty four (24) hours in advance of any road crossings.
- (11) The City of Richmond Hill Inspections Department shall be notified twenty four (24) hours in advance of any tie into an existing manhole.
- (12) Street sub grades and right of way grades shall be within two tenths (.20) of finish grade before any utilities are installed. Utility installation shall not occur until the City Inspections Department has approved the rough grade of the street and right of ways.
- (13) Sanitary sewer mains shall be green in color unless the City Engineer approves otherwise.
- (14) Force main pipe shall be white or green in color unless the City Engineer approves otherwise.
- (15) Sanitary sewer laterals shall be green or white unless the City Engineer approves otherwise.
- (16) See the City of Richmond Hill's current installation guide for grinder pump installation when grinder pumps are allowed to be used.

Section 1201 Testing

The Contractor shall perform the following tests with a representative from the City of Richmond Hill Inspections Department and the Design Engineer present.

- (1) Pipe Deflection: A minimum of thirty (30) days after backfilling trenches, all PVC sewer pipe shall be tested for initial diametric deflection by the use of a five (5%) percent deflection mandrel which is acceptable to the Engineering Director. The initial diametric deflection shall not exceed five (5%) percent. A representative from the City of Richmond Hill Inspections Department, the Design Engineer and the contractor must be present at all such testing.
- (2) All sanitary sewer mains shall be inspected using a light and mirror to check for alignment and any other deficiencies.
- (3) All sanitary sewer laterals shall have tennis balls dropped through lines to make sure connections have been tied into main.

- (4) If deemed necessary by the City of Richmond Hill Inspections Department and/or the City Engineer, a video shall be done of the sanitary sewer system. The developer/owner is responsible for the cost of the video.

- (5) Soil Compaction:

All trenches determined by the City of Richmond Hill Inspections Department and /or City Engineer not to meet the compaction requirements stated previously for Roads shall be tested for conformance by a testing laboratory approved by the City Engineer at the locations and depths requested by the City of Richmond Hill Inspections Department and/or City Engineer.

- (6) Pressure Test:

All force mains shall successfully pass a pressure test of one and one-half (1/2) times working pressure, but in no case less than 100 psig.

The formula for allowable pressure loss will determine if a force main is acceptable. No installation shall be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = SD \sqrt{P / 133,200}; \text{ where:}$$

L = Allowable leakage in gallons per hour

S = Length of pipeline tested in feet

D = Diameter of pipe in inches

P = Average test pressure in PSIG

Exceptions: All visible leaks shall be corrected regardless of the amount of leakage. Whenever the pressure loss falls 5 PSI or more in 2 hours, a retest is required.

Section 1202 Manholes, Pipes, Connections

- (1) Service laterals shall be connected to the sewer main. Under special conditions and with prior approval, service laterals may be connected to manholes with the crown of the sewer lateral matching the crown of the sewer main. A concrete slide from the incoming pipe invert to the MH invert must be constructed.

- (2) Service laterals longer than one hundred fifty (150) feet shall be six (6) inches in diameter and shall not exceed two hundred (200) feet in length. Service laterals less than one hundred fifty (150) feet may be four (4) inches in diameter on single Unit or where approved by the City Engineer. Lateral is defined as the pipe laid from the sewer main to the property line of the future building. Sewer laterals for multifamily, commercial buildings or motels shall be six (6) inches, unless the City Engineer approves otherwise.
- (3) Connections to existing manholes shall be made in the presence of the representative of the City of Richmond Hill Inspections Department. The Contractor shall notify the City's Inspections Department twenty four (24) hours before starting on the connection. All connections made to precast reinforced concrete manholes shall be cored and have installed a flexible manhole sleeve.
- (4) Pipe Protection: Sewer pipe which, when completed, will have less than three (3) feet of cover shall be constructed of ductile iron pipe.
- (5) Manhole tops should be above the ten (10) year flood elevation. Manhole tops in pavement lower than the ten (10) year flood elevation shall have a watertight ring and cover. Manholes constructed in public right-of-ways or easements shall have top a maximum of six (6) inches above grade, unless greater height is needed to reach ten (10) year flood elevation.
- (6) All sewers shall be so designed and constructed to have the following minimum slopes and where possible greater slopes are desirable : (minimum velocity of two (2) feet per second shall be determined to allow larger pipes)

<u>Sewer Size</u>	<u>Minimum Slope in Feet Per 100 Feet</u>
8 inch	0.40
10 inch	0.28
12 inch	0.22

- (7) All dead-end sewers (8" diameter) shall be laid at a minimum slope of 0.70 feet per one-hundred (100) feet.
- (8) No more than two (2) Units shall be connected to one (1) six (6) inch sewer lateral. Both laterals must be equipped with cleanouts at the connection to the six (6) inch line.
- (9) Ductile iron pipe, which crosses a road, with less than twelve (12) inches of cover

below asphalt shall be encased in concrete.

Section 1203 Underwater Force Main Crossings

A minimum cover of four (4) feet shall be provided over the force main. When crossing water courses which are greater than fifteen (15) feet in width, the following shall be provided:

- (1) The pipe shall be Ductile Iron. The City Engineer can approve an acceptable alternative design.
- (2) Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding. The valves shall be installed in a manhole or vault. This section can be deleted if determined the valves are not needed.
- (3) Permanent taps shall be made on each side of the valve on the source side to allow insertion of a small meter to determine leakage and for sampling purposes.

Section 1204 Sewer Material

- (1) Pipe: All PVC sanitary sewer main pipe shall be green or white in color

Pipe Size and Type Selection

- (a) On depths of 1 to 3.75 feet, use DIP
- (b) On depths of 3.75 to 12 feet, use PVC SDR-35 or PVC SDR-26
- (c) On depths of 12 feet and greater, use PVC SDR-18, PVC SDR-26 (ASTM D-3034), or DIP at Applicant's Engineer's option
- (d) Any pipe above 16" diameter shall be DIP, regardless of depth
- (e) Pipe enclosed in casing shall be DIP only

(2) Pipe Material Specifications:

All pipe shall be marked as to the type, class or nominal thickness, weight, manufacturer, and date of production. Pipe not properly marked shall be unacceptable and removed from the job.

- (a) Ductile Iron Pipe (DIP): DIP shall conform to the requirements of ANSI Specifications A21.51. The pipe shall be designed for the actual cover installed. Joints shall be push-on which conform to the requirements of ANSI Specification A21.11. Ductile iron fittings shall conform to the requirements of ANSI Specifications A21.10. Joints for fittings shall be mechanical joints conforming to the requirements of ANSI Specifications A21.11. All ductile iron pipe and fittings shall have a cement-mortar lining of 45 mil thickness minimum conforming to the requirements of ANSI Specifications A21.4. Ductile iron fittings must be used on pipe sized 3 inches or larger.
- (b) Poly Vinyl Chloride (PVC): PVC pressure sewer pipe shall conform to the requirements of ASTM Specifications D-2241, Class 160 - SDR 26. Joints shall be mechanical joint type utilizing synthetic rubber ring gaskets conforming to the requirements of ASTM Specifications D1869 and shall be ductile iron.

PVC gravity sewer pipe and fittings shall conform to the requirements of ASTM Specifications D3034-SDR 35 for pipe 4"–15" and ASTM Specifications F-679 for pipe 18"– 24". Pipe shall be designed for maximum long term deflection that shall not exceed five (5%) percent. PVC fittings may be used on pipe smaller than three (3) inches in size.

- (c) Magnetically Detectable Tape: All PVC sewer mains and lateral installations shall include the installation of a continuous electronically or magnetically detectable tape buried directly over the pipe at a depth of twelve (12) inches below the finished grade. The tape shall be at least two (2) inches wide, and boldly labeled every eighteen to thirty-two (18 - 32) inches as follows: CAUTION SEWER LINE BURIED BELOW. Tape marking sanitary sewer lines shall be green striped; force mains, reclaimed water mains, and effluent lines should be brown striped. The tape shall be designed to last as long as the pipe it is installed over, even in adverse soils. Tracer wire shall be attached to pipe and laterals.

(3) General Information

- (a) All materials used in the construction of sewers shall be new and unused when delivered on-site and shall be suitable for installation and operation under the conditions for which they are to be used.
- (b) Casing pipes shall be installed at:
 - (i) Railroad Crossings, as directed by the Railroad;
 - (ii) State highway crossings, as directed by the Georgia Department of Transportation, or;
 - (iii) as designated by the Engineering Director.
- (c) No sewer line of any type shall be allowed to pass through any storm drainage structure.

Section 1205 Manhole Construction

- (1) Sections: Manhole sections shall be precast reinforced concrete sections with tongue and groove joints and shall conform to ASTM Specification C478, latest revision. The number of manhole joints shall be minimized. Riser sections for manholes shall be made as long as practical to accomplish this requirement.

Alternative 1:

Concrete used in their manufacture shall conform to the requirements of ASTM C-150 (type II) and shall be manufactured with 100% calcareous aggregate (limestone) conforming to the requirements of ASTM C-33 with a concrete alkalinity of not less than 0.80 and shall have a twenty-eight (28) day compressive strength to not less than 5,000 pounds per square inch and the absorption shall not exceed four (4%) percent. The minimum wall thickness of the manhole riser section shall be:

4' Diameter Manhole	4" Minimum Wall Thickness
5' Diameter Manhole	5" Minimum Wall Thickness
6' Diameter Manhole	6" Minimum Wall Thickness

Cone sections shall be eccentric and have a minimum wall thickness of eight (8) inches at the top and shall have a side thickness to match the section with which it is associated.

Base riser sections shall be monolithically cast and have minimum bottom thickness of:

4' Diameter Manhole	6" Minimum Bottom Thickness
5' Diameter Manhole	8" Minimum Bottom Thickness

6' Diameter Manhole

8" Minimum Bottom Thickness

Alternative 2:

Concrete used in their manufacture shall be made with granitic stone only and shall have a twenty-eight (28) day compressive strength to not less than 5,000 pounds per square inch. Alkalinity shall be adjusted to provide a Life Factor, A_z = calcium carbonate equivalent times cover over reinforcement, no less than 0.35. Calcium chloride or admixtures of calcium chloride shall not be used. Manhole interior and exterior walls shall be coated with 1/8 inch of Coal Tar Epoxy, Koppers 300 M, or equal. The minimum wall thickness of the manhole riser section shall be:

4' Diameter Manhole

5" Minimum Wall Thickness

5' Diameter Manhole

6" Minimum Wall Thickness

6' Diameter Manhole

7" Minimum Wall Thickness

Cone Sections shall be eccentric and have a minimum wall thickness of eight (8) inches at the top and shall have a side thickness to match the section with which it is associated.

Base riser sections shall be monolithically cast and have minimum bottom thickness of:

4' Diameter Manhole

6" Minimum Bottom Thickness

5' Diameter Manhole

8" Minimum Bottom Thickness

6' Diameter Manhole

8" Minimum Bottom Thickness

(2) Openings:

Suitable openings for inlet and outlet sewer pipe shall be cast into the base sections and into riser sections for drop connections. These openings shall be circular, accurately made, and located as required for each manhole. Base riser sections shall be set on compacted pipe embedment material twelve (12) inches in thickness.

(3) Joint Sealant:

A flexible plastic joint sealant shall be applied to manhole section joints. The sealant shall be a factory extruded formulation of one hundred (100%) percent solids with top-quality partially vulcanized butyl rubber which provides shape retention in combination with adhesion and cohesion. The sealant shall conform to the requirements of Federal Specifications SS-S-210A. It shall be applied to clean, dry surfaces only. After manhole sections are jointed, the inside of the joint shall be covered with a smooth tapered coat of non-shrink grout to thickness of one-half (2) inch at the joint. The outside of the joint shall be covered with a six (6) inch wide strip of polyethylene backed flat butyl rubber sheet no less than 1/16" inch thick and shall

over lap at the ends a minimum of six (6) inches.

(4) Flexible Manhole Sleeves:

Flexible manhole sleeves of flexible manhole entrance joints shall be installed on all pipe entering and leaving manholes. Flexible manhole sleeves shall be installed on all pipe twenty-one (21) inches in size and smaller. Flexible manhole sleeves shall be Type I or Type II. Type I sleeves shall be of a high quality synthetic rubber terminating in a substantial serrated flange of the same material. The flange shall be cast into the wall of the manhole base or section to form a tight water-stop. Minimum thickness of the sleeve material shall be 3/8 inch. Sleeve material shall comply with the requirements of ASTM Specification C 923. Sleeves shall be secured to the sewer pipe to make a watertight union with stainless steel strap clamps, draw bolts, and nuts. Type II sleeves shall be high quality synthetic rubber having a minimum thickness of 3/8 inch which complies with the requirements of ASTM Specification C923. Manhole openings shall be accurately core drilled. The sleeve shall be secured to the manhole by a stainless steel band with self-locking toggle to make a watertight union. The sleeve shall be secured to the sewer pipe to make a watertight union with stainless steel clamps, draw bolt, and nuts.

Manholes sections shall be scored or stamped with the date of castings and the date shall appear on the inside of the cone section.

(5) Manhole Inverts:

Manhole inverts shall be constructed of cement grout and shall have the same cross-section as the invert of the sewer which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in direction of flow through the sewer shall be made to a true curve with as large radius as the size of the manhole will permit. Inverts shall be "U" design with top of the "U" even with the crown of the pipe. Invert piping shall not extend inside the manhole any further than two (2) inches. Slope of inside of invert bench shall be a minimum of two (2) inches higher than the crown of the pipe. When dissimilar pipe sizes occur, the elevation of the crown of the pipe shall be the same.

(6) Manhole Frame & Covers:

After the manhole has been set in the final position, the cast iron frame for the cover shall be carefully set at the required elevation and properly bonded to the masonry with cement grout. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted so as to conform to the exact slope, crown and grade of the existing pavement adjacent thereto.

Manhole frame and covers shall be made of cast iron conforming to the minimum requirements of ASTM Specifications A48, Class 35. There shall be a clear opening of 23 $\frac{3}{4}$ " inches through the frame. All casting shall be made accurately to the required dimensions and shall be sound, smooth, clean and free from blisters and other defects. The contact surfaces between the cover and its corresponding supporting ring in the frame shall be machined so that the cover will rest on the ring for the full perimeter of the contact surface. Castings shall be thoroughly cleaned by shot blasting and shall remain unpainted. There shall be no holes or perforations in the cover.

(7) Leveling & Final Grade:

Leveling and final grading of manhole frames and covers shall be accomplished by using a maximum of two (2) concrete grade rings. Concrete grade rings shall not exceed four (4) inches in thickness. Grade rings shall be laid in a full bed of non-shrink grout and covered after laying with a smooth coating of non-shrink grout or hydraulic cement a minimum of one-half (2) inch thick.

(8) Manhole steps:

All manhole steps shall comply with the current requirements of OSHA.

(9) Lifting Loop or Holes:

Lifting loops shall be ASTM 416 steel strand and shall not penetrate through the walls of the section. When holes are employed for lifting, the holes shall conform to the recommended design in accordance with OSHA Standard 1926.704. Lifting holes shall be sealed using a butyl rubber plug driven to resistance and covered with a coal tar epoxy, Koppers 300M, or equal.

(10) General:

- (a) Where the difference in the invert elevation of two (2) or more sewers intersecting in one (1) manhole is two (2) feet or more, a drop manhole shall be constructed. Drops shall be made outside of the manhole and made of ductile iron or C-900 PVC and supported by Class B concrete. Drops can be made inside of manhole with the City Engineer's approval.
- (b) Where work requires special stream, railroad, highway, or other extraordinary conditions, or where alternate types of construction are required not covered by these Engineering Standards, the materials and construction method shall be submitted for approval to the City Engineer.
- (c) All manholes shall be eccentric design unless prior approved by the City Engineer.
- (d) Minimum depth of end manhole shall be four (4) feet unless approved by the City Engineer.
- (e) Transition top sections shall provide an eccentric transition from sixty (60) inches and larger manholes to forty-eight (48) inches in diameter risers and cone top sections. Transition top sections shall not be used in areas subject to vehicle traffic.
- (f) All manholes constructed in an area of vehicle traffic shall be designed for the maximum load expected and shall be designed for a minimum HS-20 traffic loadings as defined by ASTM C890.

Section 1206 Sewage Air and Vacuum Release Valves

Sewage air and vacuum release valves shall be installed at all high points in the force main and shall be laid to grade shown on the plan/profile sheet. Marker tape and tracer wire shall be used. Valves shall automatically exhaust large quantities of air and gases while the pipeline or systems is being filled and allow air to re-enter during draining or whenever a negative pressure exists. Applicant's Engineer shall submit design consideration for selection of valves based on operation of the system and proper sizing the orifice diameter. Valves shall be housed in manholes or vaults that allow sufficient access and working area.

Section 1207 Sewer Detailed Drawings

(1)	Shallow Manhole	S -1
(2)	Sewer Connection & Outside Drop MH	S -2
(3)	Bedding for Pipe	S -3
(4)	Precast Manhole Joint Detail	S -4
(5)	Standard Manhole All Applications	S -5
(6)	Air Release Valve Manhole	S -6
(7)	Sewer Service Connection	S -7
(8)	Inside Drop Manhole	S-8
(9)	Sanitary Sewer/Water Separation	S-9
(10)	Lateral Location	S-10
(11)	Joining Dissimilar Pipe	S-11
(12)	Sewer Service Connection to Existing Pipe	S-12
(13)	Grinder Pump Installation	S-13
(14)	Sample Sanitary Sewer Certification Letter	S-14

Section 1208 Wastewater Pump Station Construction

This section of the Engineering Standards is provided for the purpose of outlining items required in a majority of wastewater pump stations, but is not intended to cover all special conditions of Applicant's Engineer's special requirements.

General:

Site dimensions shall be sufficient to provide a space for the wet well, electrical control panel, hose bibb, yard lighting, and receiving manhole. Access and maintenance shall be considered when site is designed.

The Site shall be fenced. See detail PS-3.

The entire site shall be covered with filter fabric covered with four (4) inches of clean stone. This covering should extend one (1) foot outside the fenced area. Stone shall be No. 57.

A power pole should be located in such a manner so the electric meter can be easily read from outside the fenced area and the service pole used for yard lighting.

All power lines within the site shall be underground. No overhead power line will be allowed to cross the site.

The site shall be serviced by an all weather road with the top elevation of road as local roads with a maximum slope of 6.0%. The road and site drainage shall be approved by the City Engineer.

A yard hydrant shall be supplied with locking capability and with approved vacuum breaker installed on outlet. The Applicant must provide a gate valve and valve box in the water line and a reduced pressure backflow preventor valve prior to the yard hydrant at the supply main. The yard hydrant shall be of sufficient size to provide adequate volume and pressure to facilitate washing down of pump and maintenance of the wet well.

A receiving manhole must be located in the fenced area of each pump station for by-pass pumping.

Wet Well shall be lined with a factory installed HDPE/PP-R moisture/chemical barrier specifically developed to withstand severe effects of hydrogen sulfide within the wet well. The liner shall be a minimum of 80 mils thick. The interior liner shall be sure-grip by Foley Products or equivalent.

Pump station shall be SCADA ready.

Frame elevation of wet well, valve box and receiving manhole shall be set at or above 100 year flood elevation.

Elevation to bottom of electrical panel shall be set at or above 100 year flood elevation.

Section 1209 Design Considerations

Applicants Engineer should submit the following design considerations:

- (1) Station service area ultimate loading.
- (2) Flotation calculation (weight of station without pumps vs. uplift).
- (3) Cycle time calculation maximum ten (10) cycles/hour.

Section 1210 Pumps and Motors (Submersible Stations)

- (1) Pumps shall be designed to handle peak flow with the largest pump out of service. Minimum design peaking factor shall be 2.5.
- (2) Motors shall be non-overloading over entire pumping range and have a 1.10 service factor.
- (3) No add-a-phase systems shall be allowed.
- (4) Unbalanced voltages on motors under load shall not exceed one (1%) percent when measured at the motor disconnect terminals. Voltage measurements shall be read with an accurate digital volt meter; and reading shall be recorded as part of the final inspection. System will not be accepted until unbalance has been corrected. Applicant's Engineer shall supply certification that the station has passed this requirement.
- (5) Pump stations shall be equipped with emergency stand-by power connections and piping connections for by-pass pumping.

Section 1211 Testing

- (1) Start up service shall be provided by the manufacturer's representative prior to acceptance of the pump station. Simplex and duplex draw-down test shall be performed by Applicant's Engineer prior to final acceptance of the pump station. Specifications to include completion of pump station start-up procedures in the presence of a representative of the City's Inspections Department, Public Works Department, Design Engineer, contractor and the pump supplier.
- (2) Applicant's Engineer shall provide a certification that the work has been completed in accordance with the approved plans and specifications.

Section 1212 Wastewater Pump Station Details

- | | |
|-----------------------------------|------|
| (1) Pump Station Site Plan | PS-1 |
| (2) Antenna Mounting (Pole Mount) | PS-2 |
| (3) Wastewater Pump Station Fence | PS-3 |

ARTICLE 13

URBAN REUSE SYSTEMS

Section 1300 RECLAIMED WATER DISTRIBUTION SYSTEM

The Contractor shall comply with all local codes and regulations of local utilities. He shall coordinate work necessary for the completion of utilities with local utility companies and cooperate with the companies as required. The Reclaimed Water Distribution System shall comply with Georgia Environmental Protection Division's "Guidelines for Water Reclamation and Urban Water Reuse", latest revision.

Section 1301 PRODUCTS:

All pipe material, solder and flux shall be lead free (less than 0.2 percent lead in solder and flux and less than 8.0 percent lead in pipes and fittings). All materials shall be certified for conformance with American National Standards Institute / National Sanitation Foundation Standard 61 (ANSI/NSF61).

Metal Pipe:

- A. Ductile Iron Pipe- Ductile iron pipe shall be manufactured in accordance with ANSI /AWWA C 151 /A21.51, latest revision. All pipes larger than 12" shall be ductile iron.

Ductile iron pipe shall be of the thickness according to ANSI/AWWA\ C150/A21 .50, latest revision, for Laying Condition Type 2, at a minimum.

Flange Pipe shall be Pressure Class 350.

- B. Fittings- Fittings shall conform to ANSI/AWWA C III A21.11, latest revision, and shall be push-on-type unless otherwise shown.

Flanged Fittings shall conform to ANSI/AWWA C110/A21.10, latest revision. The AWWA C 110 fitting flanges shall have facing and drilling which match AWWA C115 threaded-on flanges which also match ANSI B16.1 Class 125 flanges except where Class 250 are specifically noted.

Mechanical Fittings shall conform to ANSI/AWWA C153/A21.53, latest revision. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall conform to ANSI B18.2.2, latest revision. Bolts and nuts

shall conform to ANSI B1 .1

- C. Joints- Push-on Joints shall conform to ANSI/AWWA C 111 /A21.11 latest revision. Flanged Joints shall conform to ANSI/AWWA C115/ A21.15, latest revision. Use only full-face type, red rubber gasket, one-sixteenth inch thick, as manufactured by the U.S. Rubber Company, in all flanged joints.

Mechanical Joints shall conform to ANSI/AWWA C111 /A21.11, latest revision. All joints of mechanical joint ductile iron and fittings shall be installed in accordance with the requirements of AWWA C600, Section 3.4. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall conform to ANSI B-18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

Restrained joints for pipe, valves, and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push-on type joints equivalent to "Lock-Ring," "TR Flex," or "Super-Lock," and shall have a minimum rated working pressure of 250 psi. The coating shall consist of a minimum of two coats of liquid Xylan® fluoropolymer coating with heat cure to follow each coat. The coating system shall be Mega-Bond™ by EBAA Iron, or approved equal. Restrained joints shall be capable of being deflected after assembly and they shall have a preset deflection of no more than 5 degrees while being able to take up to 3 degrees of deflection after burial.

- D. Lining and Coating- Lining for ductile iron pipe and fittings shall be a cement mortar lining meeting the ANSI/AWWA C 104/ A2 1.4, latest revision, for standard thickness lining. After cement lining, the interior of the pipe shall be given a seal coat of approved bituminous material in accordance with ANSI/AWWA C 04/A21.4, latest revision.

Exterior coating shall be an approved bituminous coating one mil thick in accordance with ANSI/AWWA C 151 / A21.51, latest revision.

- E. Protective Coating- Pipe and fittings shall be coated in the field by an approved painting subcontractor. The subcontractor's experience qualifications shall be submitted for approval by City of Richmond Hill.

Buried ductile iron pipe and fittings shall be color coded as per general color code requirements listed in the Utility Location and Coordination Council's Uniform Color Code. Reclaimed water main

pipe, joints, and fittings shall be marked with Pantone Purple 522C.

The coating shall cover the top 180 degrees of the pipe outside diameter, except for the spigot area. The standard asphaltic pipe coating shall not be deleted if field painting is selected. The paint shall be an all acrylic, water reducible, fast drying, semi-gloss coating and shall be suitable for painting over asphaltic coatings. Coating data shall be as follows:

- Surface preparation: clean and dry
- Coverage: theoretical 615 square feet per gallon at 1.0 mil dry film thickness
- Dry film thickness: 1.0-2.0 mils per coat
- Wet film thickness: 3.0-8.0 mils per coat

Apply coating in accordance to manufacturer's recommendations.

Paint shall be manufactured by Induron or approved equal.

After installation, the Contractor shall paint all steel sleeves, tapping sleeves, threaded rods, straps, nuts, bolts, washers, couplings, or other connecting/restraining apparatus with either Roster Laboratories, Inc., "Roskote Mastic No. A-939", Koppers Company, Inc., "Bitumastic Superservice Black", or approved equivalent protective coating.

PVC Pipe:

PVC pipe shall be Underwriters Laboratories approved and listed and must meet all requirements of ASTM D2241 and bear the seal of conformance to NSF61. PVC pipe used for reclaimed water mains shall be color-coded using sunlight stable pigment Pantone Purple 522C. It shall meet or exceed AWWA C900 with the following supplemental specifications:

- A. Pressure Pipe- Pipe less than 4 inches shall be Polyethylene Pipe, 200 psi, SDR-7CTS. Pipe 4 inches to 12 inches shall be C-900 with Dimension Ratio 18 or lower (thicker). Plastic pipes are not allowed for sizes larger than 12 inches.
- B. Routine Hydrostatic Proof Test Requirements- Each piece of pipe shall be tested at four (4) times rated pressure class by the Manufacturer.
- C. Outside Diameter- Pipe shall have cast iron pipe outside diameter.

- D. Joints- Pipe shall have elastomeric-gasket integral bell end. Bell section shall have a thickened wall. Gasket groove Wall thickness shall meet or exceed the thickness of the pipe barrel.

Mechanical Joints shall conform to ANSI/AWWA C11 I/A21.11, latest revision. All joints of mechanical joint ductile iron and fittings shall be installed in accordance with the requirements of AWWA C600, Section 3.4. Bolts shall conform to ANSI B18.2.1, latest revision. Nuts shall conform to ANSI B18.2.2, latest revision. Bolts and nuts shall conform to ANSI B1.1

Restrained joints for pipe, valves, and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push-on type joints equivalent to "Lock-Ring," "TR Flex," or "Super-Lock," and shall have a minimum rated working pressure of 250 psi. The coating shall consist of a minimum of two coats of liquid Xylan® fluoropolymer coating with heat cure to follow each coat. The coating system shall be Mega-Bond™ by EBAA Iron, or approved equal. Restrained joints shall be capable of being deflected after assembly and they shall have a preset deflection of no more than 5 degrees while being able to take up to 3 degrees of deflection after burial.

- E. Fittings- Ductile iron shall be mechanical-joint type conforming to ANSI /AWWA CI53/A21.53, latest revision, with cement mortar lining and seal coat in accordance with ANSI/AWWA CI04/A21.4, latest revision, and one mil thick petroleum exterior coating in accordance with ANSI/AWWA CI04/ A21.4, latest revision, unless otherwise shown.
- F. Affidavit of Compliance- The manufacturer shall furnish an affidavit that all materials delivered comply with the requirements of this standard and supplemental specifications.
- G. Couplings and Fittings- Couplings and fittings shall be furnished by the pipe manufacturer and shall accommodate the pipe for which they are to be used. They shall have the same minimum pressure rating as the pipe. Coupling method shall allow for expansion or contraction of each pipe section to be taken up at each end of the pipe. Couplings shall permit five (5) degree deflection (2 2 degrees on each side) of the pipe with any evidence of infiltration, exfiltration or breaking.
- H. Gaskets- PVC pipe joint gaskets shall meet the requirements of

ASTM F477.

Steel Casing and Casing Spacers:

Steel casing and casing spacers shall be manufactured and installed as specified below,

- A. Casing pipe shall be steel conforming to ASTM A139, yield point of 35,000 psi, of the diameter and thickness shown on the contract drawings for each crossing. All pipe within casing shall be restrained joint ductile iron.
- B. Casing spacers shall be bolt on style with a shell made in two (2) sections of Heavy T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner. All nuts and bolts shall be 18-8 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of Heavy T-304 Stainless Steel. The combined height of the supports and runners shall keep the carrier pipe a minimum of 0.75" from the casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or approved equal.

Gate Valves:

Gate valves shall be right hand operational only and shall conform to the following Specifications:

- A. Resilient- Seated Gate Valves (3 Inches to 12 Inches) - Resilient-seated gate valves 3 inches to 12 inches shall conform to AWWA C509 with non-rising stem.

Unless otherwise indicated or specified, gate valves shall be designed for a working pressure of not less than 250 psig.

Valves shall take full pressure on either face. Valves shall be from one manufacturer and similar sizes shall be identical and parts interchangeable. They shall be constructed with bolted bonnets provided with two O-ring stem seals, which can be replaced with the valve under pressure in the full-open position.

Valves shall be constructed of materials conforming to AWWA C509. All internal and external surfaces shall be coated with fusion-bonded epoxy to a minimum thickness of 8 mils.

Valve seats shall be coated with a rubber material conforming to AWWA C509 so that there shall be no rubber to metal contact when the valve is in the fully closed position.

Valves shall be hydrostatically tested in accordance with AWWA C509.

Valves shall be American, Waterous or approved equal and shall be furnished with standard hand wheels, chain wheels or nuts as shown on the Drawings and/or as specified.

- B. Ball Valves (2 Inches & Smaller)- Ball valves 2 inches and smaller shall be designed for a working pressure of not less than 300 psi, domestic made brass, and shall conform to AWWA standard C 800-89.
 - a) Standard tee head stops in body permit 90-degree right turn only.
 - b) Padlock wings shall be used on the tee head.

Butterfly Valves 14 Inches and Larger:

- A. Butterfly Valves 14 Inches and Larger - Butterfly valves 14-inches and larger shall be of the tight closing, right hand operational only, rubber seated type, with rubber seat positively locking in place against flow from either direction. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction. Butterfly valves shall conform to ANSI/AWWA C504, Class 150B.

Valve body shall be high-strength cast iron ASTM A 126 Class B with 18-8 Type 304 stainless steel body seat. Valves shall have Mechanical Joints per AWWA

C 111. All MS accessories (bolts, glands, gaskets) shall be supplied by the valve manufacturer. Valves for below ground service shall be installed using restrained joints.

Valve shafts shall be 304 stainless steel and shall consist of a one-piece, extending full size through the entire valve or 18-8 stainless steel stub shaft design keyed to the vane with stainless steel torque plugs.

Valve discs shall be solid ductile iron with an epoxy coating making it corrosion resistant. The thickness of the discs shall not exceed 2-1/4 times the shaft diameter.

Valve seats shall be natural or synthetic rubber providing 360 degrees uninterrupted seating. The resilient seat shall be adjustable or replaceable in the field without burning or grinding. The seat shall be molded over a stainless steel ring for support and secured to the disc by corrosion resistant, self-locking stainless steel screws.

All internal ferrous metal surfaces in the waterway shall be factory coated with a non-toxic, two-component, holiday-free, thermosetting epoxy to a nominal thickness of 4 mils. All external surfaces shall be coated with an epoxy coating conforming to AWWA C-550, with a minimum thickness of 10 mils.

All butterfly valves shall be manually operated. Operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position without creeping or fluttering. Operators shall be furnished with externally adjustable mechanical stop limiting devices. Valves shall have a 2-inch square-operating nut and shall be installed with extension stems to extend the operating nut in accordance with the project details. The operator shall be integrally mounted on the valve-mounting flange and shall have all gearing totally enclosed for buried service. Maximum force for operating nut shall be 40 pounds.

All valves shall be M&H model 4500, or approved equal.

- B. Tapping Sleeves and Valves- Tapping sleeves and valves shall be used for making branch connections to an existing water main. Tapping sleeves shall be provided at the locations indicated on the Drawings and shall be mechanical joint type, Mueller No. H-61 5, Clow F-5205 or approved equal. Tapping valves shall be mechanical joint type gate valves, Mueller No. 667, Clow F-5093 or approved equal, and shall conform to the requirements of this Section.
- C. Tapping Saddles (Service Saddle)- Tapping saddles shall be used for making service connections on 4" and larger PVC and/or Ductile Iron Pipe. Drawings shall show a Smith Blair Series 317 service saddle or approved equal. At

each point where a 1" or 2" connection is required.

- D. Air Release Valves- Air Release Valve shall be 2-inch screwed inlet. The air release valve shall be designed to permit automatic escape of large quantities of air from the pipeline when the line is being filled and must also allow accumulating air to escape while the line is in operation and under pressure. The body and cover shall be able to operate at pressures up to 300 psi. The open end of and air relief pipe from automatic valves or from a manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.

Air release valve manufacturer shall be Crispin Model No. PL- 10 or VENT 0 MAT Series RBX, or approved equal.

- E. Water Service Pipe Material- Pipe shall conform to AWWA Specifications C901-96, Polyethylene Pressure Pipe and Tubing, and shall be marked with AWWA requirements and the following:

<u>Polyethylene</u>	<u>To Be Marked On Pipe</u>
Nominal Size	X
ASTMD2837	X
SDR 9	X
PE 3408	X
Working Pressure- 160 psi	X
Water Service Tubing	X
National Sanitation Foundation (NSF 14)	X
Pipe Color	Pantone Purple 522

Unmarked pipe, without information noted above, will not be accepted.

Polyethylene pipe shall comply with ASTM DI 248 PE3408 Class III, A, 5, P34. Brass (Domestic Made) or bronze compression type fittings shall be used. Flared connections will not be permitted. Continuous metallic tape over the pipe and tracing wire will be required. No gooseneck will be allowed nor will solvent weld joints be allowed. Corporation and curb stops will be required on all laterals. Minimum nominal size shall be 1 inch.

- F. Corporation Stops- At each tapped point a connection to the pipe shall be made by installing a corporation stop. Corporation stops shall be Ford F 1000-4-G AWWA/CC Ground Key Corporation Stop, or approved equal, as required for the type of pipe being tapped.

- G. Curb Stops- Curb stop shall be 1 inch size or as shown on the Drawings and shall be Ford
C 14-4401 FIP x GJCTS with a Brass, domestic made, square head cored plug, or approved equal.
- H. Service Saddles - Service saddles shall epoxy coated, ductile iron, double strap -stainless steel manufactured by Smith-Blair, Model 317 Service Saddle, or approved equal.
- I. Valve Box- Each buried valve shall be accompanied by a valve box of the adjustable type of heavy pattern, constructed of cast iron, and provided with cast iron cover.

The upper section of each box shall have a flange at the bottom, having sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the operating nut of the valve. Boxes shall be of lengths consistent with pipe depths as shown on the Drawings. Boxes shall be adjustable, with a lap of at least 6-inches when in the most extended position. Covers shall have the words "RECLAIMED WATER" cast in the top. Each valve box shall have a concrete round collar installed around the top along with a concrete valve marker at each valve.

Valve Manhole

- A. General- Manholes shall be constructed at such points as designated on the Drawings. Riser and top sections shall be installed level and plumb, such that all manhole steps are in alignment. The top of manholes outside of roads, streets and highways shall be built to grades 2 inches above ground surface, unless otherwise shown. Manholes in roads, streets and highways shall be built to grades shown on the Drawings.
- B. Precast Concrete Manholes- Precast Concrete manholes shall be constructed of reinforced Class "A" Concrete. Walls shall be not thinner than 5 inches, or 1/12 of the inside diameter, whichever is greater. Precast manholes shall meet all requirements of ASTM C478, "Specification for Precast Reinforced Concrete Manhole Sections."

Rings shall be custom made with openings to meet the necessary pipe alignment conditions and invert elevations. All inlets and outlets shall be cast in or core drilled. Joints and gaskets shall conform to the applicable provisions of ASTM C443, "Joints for Circular Concrete Sewer and Culvert Pipe using Rubber Gasket" or Ram-Nek Pre-molded Plastic Joint Sealer. The sealing compound shall not leak at the joints (while being tested, if required, at 10 psi) for a period of 24 hours. Bell and spigot surfaces shall be smooth, accurately formed, and provide a loose, sliding fit, with a clearance between the bell and spigot of not more than 1/6 inch. Precast manholes shall be bedded on not less than 6 inches of compacted crushed stone at the Contractor's expense. The crushed stone shall extend not less than 6 inches outside the walls of the manhole and under the entire length of pipe within the excavation for the manhole.

- C. Manhole Castings- Provide covers with the inscription "RECLAIMED WATER" cast into the cover in lettering at least 2 inches high. Covers shall be 25-3/4 inches in diameter and shall be 2-inches thick at the bearing surface. Frame shall provide a 24-inch clear opening. Manhole covers and frames shall be USE 227, or equal.
- D. Meter Box - 3/4" and 1" - Meter boxes shall be of cast iron and shall be 3/4" stretch box Ford LYL 141-243T or stretch box Ford LY 111 -444-YBL-T, or approved equal. The lid shall have the word "RECLAIMED WATER" cast in it.
- E. Tracing Wire- Tracing wire shall be single strand #12 AWG, Vinylon - A THWN or THHN or gasoline and oil resistant II VW 600V or AWM. Tracing wire shall be continuous with all reclaimed water mains. Tracing wire for reclaimed water laterals shall be a single strand from the main to the end of the service lateral terminating in the meter box. Tracing wire shall be a single strand installed from the main to all Utility Marking Post line markers with sufficient length at the marker to be wrapped around the marker several times.
- F. Concrete Valve Marker- Concrete valve marker shall be 4"x4" square by 4'-0" in length with 4-#3 re-bar cast in 4,000 psi concrete. All corners shall have a 3/4" chamfer. A 2" brass marker plate with anchor shall be embedded in the top. The brass plate shall have a directional arrow pointing to valve with the distance to the nearest foot and shall be labeled "Reclaimed Water Valve". The concrete valve marker shall be set 24" in the finish grade and shall be painted Pantone Purple 522.

- G. Utility Marking Post- Utility marking post shall be placed every 500 feet or as shown on the Drawings above the utility and at fittings and labeled accordingly. The marking post shall be rigid enough to be easily installed in most soil conditions and durable to withstand repeated impacts. The marking post shall be a four (4) inches in width and remain flexible from -40E F to +14OEF with UV stabilizers. The marker shall highly visible standard fade resistant colors, White Background and Pantone Purple 522 Lettering with the following imprinted thereon: international ANO Dig@ symbol, federal law warning, "RECLAIMED PIPELINE" with letter size and stroke to comply with the Federal Office of Pipeline Safety Specifications, City of Richmond Hill's name, Water Distribution phone number and State one-call number. Markers shall be Rhino 3-Rail with poly tech coating, or approved equal.
- H. Caution Tape- Caution tape shall consist of a minimum 4.0 mil thickness inert polyethylene plastic that is resistant to alkalis, acids and other destructive elements found in the soil. The tape shall have a minimum 3" width and a minimum tensile strength of 2,800 psi. A continuous warning message repeated every 16" to 36" shall be imprinted on the tape surface. The tape shall contain Pantone Purple 522 color designating the color code appropriate to the line being buried "Caution — Buried Reclaimed Water Line Below" imprinted in black. Caution tape shall be installed 24" above the pipe on all water mains.

Section 1302 EXECUTION

Excavation, trenching, and backfill for the reclaimed water distribution system shall be as specified below. A minimum cover over the top of the pipe shall be as specified in Subpart 2.01 A.4, from the sub-grade, shoulder or finish grade. A minimum 5' face to face minimum horizontal separation between reclaimed water main and sanitary sewer and drainage lines shall be provided.

Installation:

Ductile iron pipe shall be laid in accordance with ANSI/AWWA C600; Plastic pipe shall be laid in accordance with AWWA C605, AWWA M23, ASTM D2774, UNI-Bell TJNI-B-3 and the pipe manufacturer's recommendations.

Pipe, fittings, valves, other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage. In loading and unloading, they shall be lifted by hoists or slid or rolled on skidways in such a manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Coated pipe shall be handled in such a manner that a minimum of damage to the coating will result. Damaged coating shall be repaired. Pipe shall be placed on the site of work parallel with the trench alignment and with bell ends facing the direction in which the work will proceed unless otherwise directed. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing before installation. Before installation of any materials, a City of Richmond Hill Inspector shall inspect and approve all material before installation.

Cutting pipe for inserting fittings, or closure pieces, shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise directed, pipe shall be laid with the bell ends facing the direction of laying. For lines on an appreciable slope, bells shall face upgrade. Whenever necessary to deflect the pipe from straight line, whether in the vertical or horizontal plane to avoid obstructions, the degree of deflection shall not exceed 2-1/2 degrees. No pipe shall be laid in water or when the trench condition or the weather is unsuitable for such work. Installation shall be in accordance with manufacturer's instructions.

All pipe and fittings shall be carefully lowered into the trench piece by piece by means of derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage to the pipe. Under no circumstances shall pipe or accessories be dropped into the trench. Before lowering and while suspended, ductile iron pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe shall be rejected. All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench and it shall be kept clean by approved means during and after laying. Care shall be taken to prevent dirt from entering the joint space. At all times when pipe laying is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe.

- A. Alignment and Grade- The reclaimed water mains shall be laid and maintained to lines and grades established by the plans and specifications, with fittings and valves at the required locations unless otherwise accepted by the owner. Valve-operating stems shall be oriented in a manner to allow proper operation.
1. Prior Investigation- Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised by the contractor during excavation to avoid damage to existing structures. The pipe manufacturer's recommendations shall be used when the reclaimed water main being installed is adjacent to a facility that is cathodically protected.
 2. Unforeseen obstructions- When obstructions that are not shown on the plans are encountered during the progress of work and interfere so that an alteration of the plans is required, the owner will alter the plans, or order a deviation in line and grade, or arrange for removal, relocation, or reconstruction of the obstructions.
 3. Clearance- When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the acceptance of the owner, to provide clearance as required by federal, state, and local regulations or as deemed necessary by the owner to prevent future damage or contamination of either structure.
 4. Depth of Pipe- The Contractor shall perform excavation of whatever substances are encountered to a depth that will provide a minimum cover over the top of the pipe of 36-inches from the existing or proposed finished grade, for pipe 12-inches and smaller. Pipe larger than 12-inches in diameter shall have 48-inches of cover from the finished grade. A maximum cover of 60" (inches) from finished grade shall be used unless approved by the City to avoid a conflict. If the cover will be less than 36", duct iron pipe shall be used.
 5. Fluorinated Hydrocarbon Gaskets- Fluorinated hydrocarbon gaskets are intended for use in soils where a possibility of petroleum contamination is present. Fluorinated hydrocarbon gaskets shall only be used where specifically called for on the drawings.

- B. Trench Construction - The trench shall be excavated to the alignment, depth, and width specified or shown on the plans and shall be in conformance with all federal, state, and local regulations for the protection of the workers.
1. Trench Preparation- Trench preparation shall proceed in advance of pipe installation only as far as stated in the specifications or as directed by the owner. Discharge from any trench-dewatering pumps shall be conducted to natural drainage channels, storm sewers, or as directed by applicable regulatory agencies. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways, or other structures. Placement of excavated material shall be done in compliance with federal, state, and local regulations.
 2. Pavement Removal- Removal of pavement and road surfaces shall be a part of the trench excavation. The amount removed shall depend on the width of trench required for installation of the pipe and the dimensions of the area into which valves, hydrants, manholes, or other structures will be installed. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe, valves, hydrants, specials, manholes, and other structures by more than 6 inches in any direction, unless otherwise required or accepted by the owner. Methods such as sawing, drilling, or chipping shall be used to ensure the breakage of pavement along straight lines. Pavement removal shall occur in accordance with the City of Richmond Hill standard details.
 3. Width- The width of the trench at the top of the pipe shall be the same as that afforded by the single-pass capabilities of normally available excavating equipment, and shall be ample to permit the pipe to be laid and joined properly and to allow the backfill to be placed as specified. Trenches shall be of such extra width, when required, to permit the placement of timber supports, sheeting, bracing, and appurtenances as required by the safety requirements of the agency having jurisdiction.

4. Bell holes- Holes for the bells shall be provided at each joint, but shall be no larger than necessary to allow joint assembly and to ensure that the pipe barrel will lie flat on the trench bottom. Push-on type joints require only minimum depressions for bell holes. Other than noted previously, the trench bottom shall be true and even to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle without damaging coating or polyethylene encasement.
5. Clearances and bedding procedures shall be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations, that may be encountered during excavation. When encountered, all structures shall be removed to provide a clearance below and on each side of all pipe, valves, and fittings of at least 18 inches for pipe sizes 24 inches or smaller and 24 inches for pipe sizes 30 inches or larger. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped.
6. Previous excavations- Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or to conform to other regulatory requirements in a manner that will prevent damage to the existing installation.
7. Protection of Property- Trees, shrubs, fences, and all other property and surface structures shall be protected during construction, unless their removal is shown in the plans and specifications or directed by the owner. Any cutting of tree roots or branches shall be done only as directed by the City of Richmond Hill Park and Tree Department. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work shall be provided in accordance with specifications or applicable regulations. All properties that have been disturbed shall be restored as nearly as practical to their original condition.
8. Unsuitable subgrade material- When the subgrade is found to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed to a minimum of at least 6 inches below the bottom of the pipe or to the depth ordered by the engineer. The removed material shall be replaced, under the direction of the engineer, with clean, stable backfill material. The bedding shall be consolidated and leveled so that the pipe may be installed.

9. Safety- Appropriate traffic-control devices shall be provided in accordance with federal, state, and local regulations to regulate, warn, and guide traffic at the work site.
- C. Pipe Installation- Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to reclaimed water main materials and protective coatings and linings. Under no circumstances shall reclaimed water main materials be dropped or dumped into the trench. Where necessary, the trench shall be dewatered prior to installation of the pipe. Chains shall not be allowed to transport or lower pipe into the trench.
1. Examination of material- All pipe, fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before installation.
 2. Pipe ends- All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign materials before the pipe is laid.
 3. Pipe cleanliness- Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time. Excessive flush water required to clean the pipe after installation may be charged to the contractor.
 4. Pipe placement- As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with acceptable backfill material.
 5. Direction of bells- It is common practice to lay pipe with the bells facing the direction in which work is progressing; however, it is not mandatory. For example, when the main is being laid on a slope, the pipe is frequently laid with the bells facing uphill for ease of installation. The direction of the bells is not functionally related to the direction of flow within the main.

6. Pipe plugs- At times when pipe-laying is not in progress, the open ends of pipe shall be closed by a temporary water-tight plug approved by the owner. The plug shall be fitted with a means for venting. When practical, the temporary plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation, should the trench fill with water. Prior to removal of a permanent plug for extending the line or for any other reason, air and/or water pressure in the line shall be released.
 7. Joint deflection- When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the amount of joint deflection shall not exceed that shown in Tables 1 or 2. The deflections listed are maximum deflections and should not be exceeded.
 8. Pipe cutting- Cutting pipe for insertion of valves, fittings, or closure pieces shall be done in conformance with all safety recommendations of the manufacturer of the cutting equipment. Cutting shall be done in a safe, workmanlike manner without creating damage to the pipe or cement-mortar lining.
 9. Cut ends and rough edges shall be ground smooth, and for push-on joint connections the cut end shall be beveled by methods recommended by the manufacturer and accepted by the owner.
- D. Reclaimed Water Service Connection- Service lines shall be connected to 4-inch and larger mains with a corporation stop. Connections to mains smaller than 4-inches shall be made with a rigid connection. Plugged tees or crosses for future connections shall be installed where shown on the Drawings. A house service connection shall be provided to vacant lots and the exact location marked on the curb with a "RW". The mark shall be made on the vertical face of the curb and shall be a minimum of 1/4-inch deep made with a branding iron. Where services are provided at locations without curb, a 2"x4" 30-inch long pressure treated flag stake painted white shall locate the end of the lateral. Minimum cover of 30-inches shall be provided until a short transition to the service is stubbed out of the ground.

Reclaimed Water service laterals installed under roadways shall be installed a minimum of 30 inches below the road (laterals shall not be installed in the base of the road). Water service laterals shall be installed one foot short of the property line of all lots along street and right -of-ways in which reclaimed water main is constructed.

- E. Brass Nipples and Brass Pipe Fittings (Domestic Made)- Threads shall be cleanly cut with sharp tools and the jointing procedure shall conform to the best practice. Before jointing, all scale shall be removed from pipe by some suitable means. After cutting, all pipe shall be screwed together with an application for graphite and engine oil, Teflon tape, or other sealing compound applied to all threads and once a joint has been screwed on it shall not be backed off unless the threads are re-cleaned and new compound or Teflon tape applied. Unions shall be installed at every connection to the supply line.
- F. Connection to Existing Reclaimed Water System- The Contractor shall furnish necessary materials and perform all excavation, dewatering, shoring, backfilling, etc., necessary to make the connection of a new reclaimed main to the existing reclaimed water main. The Contractor shall notify the Inspector and City of Savannah, a minimum of 72 hours in advance of construction. The Contractor shall be responsible for coordinating his construction with the City of Richmond Hill. No cross-connection between the reclaimed water system and the potable water system will be allowed.
- G. Damage to Reclaimed Water System- Damage to any part of the reclaimed water system by the Contractor, or subcontractors, that is repaired by City of Richmond Hill shall be charged to the Contractor on the basis of time and material, plus 30 percent for overhead and administration.
- H. Joint Restraints- All restraints shall be used in accordance with engineering and manufacturer=s specifications. Thrust block is not allowed. Joint restraints shall be: Ford 1390 Series, Mega-Lug, EBBA Series 1100 for Ductile Iron 4" and larger, EBBA Series 2000 PV for PVC Pipe 4" and larger, Flexlock, T-lock, Uni-Flange, or approved equal.

Cleaning of new reclaimed mains:

Clean the interior of all pipe by brushing, swabbing or washing out all debris before laying. Stop up all branches and other openings with wooden plugs or heads until either capped or connected. The use of a cross connection device during flushing shall be required. A flushing velocity of not less than 2.5 feet per second shall be maintained in pipe sizes less than 24-inches in diameter. For larger diameter mains, an alternative to flushing, such as broom sweeping of the main, is acceptable.

Flush the new pipe lines for a full pipe open end flush until the water runs clear at the end of all mains and laterals. This should be done after the pressure test. The Contractor is responsible for coordinating with the City Inspector and the City Water Distribution Department to arrange a City of Richmond Hill inspection. Lines will not be placed in operation until City of Richmond Hill approval and the City Inspector directs Contractor to do so.

Section 1303

Identification and Tracer Wire:

- A. Mylar tape shall be installed 18 inches below the finished grade over the top of the reclaimed water mains. The tape shall be 2 inches wide, of Pantone purple 522 color and have imprinted on the tape "Caution — Reclaimed Water Line Below." The tape shall be laid the entire length of the trench.
- B. No. 12 AWG solid plastic-coated copper wire shall be installed on top of all water mains where non-metallic pipe is used and attached by means of securing the wire on top of the water main with a 12-inch long by 2-inch wide piece of duet tape. Attach the wire to the main every ten (10) feet.

Wire shall be bonded at splices with 3M DBY-6 Direct Bury Splice Kit at every connection

The wire shall be laid the entire length of the trench and shall be continuous. The Contractor shall demonstrate continuity in wire through the entire length of the project. At every valve manhole the wire shall be run through the pipe opening, up to the ring and cover, secured at the ring by means of grouting the ring to the top of the manhole. The wire shall continue in the same loop back to the opposite pipe opening, through it and continuing in one continuous loop along the main.

At every reclaimed water service lateral, the wire shall be run from the main and corporation stop to the curb stop and attached to the polyethylene pipe by a piece of duct tape wrapped around the wire and tubing. The wire shall be connected to the tracer wire at the main with a single strand from the reclaimed water main to the curb stop or into the meter box.

Field verification of all tracer wire is required prior to acceptance.

Section 1304 TESTING:

Hydrostatic testing:

All pressure and leakage test shall be performed in accordance with the latest edition of AWWA C600. Leakage test shall be conducted simultaneously with the pressure test. The duration of the test shall be 2 hours and during the test the main or section of main under test shall be subjected to a pressure of 150 psi based on the lowest point in the line or section under test, and connected at that elevation to the test gauge. Test pressure shall not vary more than 5 psi for the duration of the test. Testing allowance shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within S psi of the test pressure after the pipe has been filled with water and the air has been expelled. Testing allowance shall not be measured by a drop in pressure in a test section over a period of time. Testing allowance is defined as the quantity of water to be supplied into the newly laid pipe or any valved section thereof, necessary to maintain the specified leakage test pressure after the air has been expelled and the pipe has been filled with water at the test pressure. No pipe installation will be accepted until the testing allowance is less than the number of gallons per hour as determined by the formula.

$$L = \frac{S \times D \times \sqrt{P}}{133,200}$$

L= testing allowance (makeup water) in gallons per hour

S=the length of pipe tested in linear feet.

D= the nominal diameter of the pipe in inches

P= the average test pressure during the hydrostatic test in pounds per square inch (gauge).

Should any test of pipe laid disclose leakage greater than the above specified, the Contractor shall at his own expense locate and repair the defective joints until leakage is within the specified testing allowance. All visible leaks shall be repaired regardless of the allowance used for testing. Line shall be retested until Testing Allowance requirement are within the allowable leakage. All additional testing shall be at the Contractors expense.

The Contractor shall provide all necessary equipment and shall perform all work required in connection with the tests. Each section shall be tested by hydrostatic pressure of 150 pounds per square inch. Each section shall be slowly filled with water care being taken to expel all air from the pipes. If necessary, the pipe shall be tapped high points to vent the air. The required pressure as measured at the point of lowest elevation shall be applied for not less than 2 hours and all pipe, fittings, valves, and joints shall be carefully examined for defects. Each valve shall be opened and closed several times during the test. Failure of valve(s) to perform will result in its removal from the job site and replacement by the Contractor at his expense. All defective joints shall be repaired or replaced.

Section 1305 General

- A. Pipes shall be sized to maintain a minimum distribution main pressure of 45 psi during peak conditions.
- B. All connections to existing reclaimed water mains shall be made in the presence of the City of Richmond Hill Inspections Department.
- C. The contractor shall furnish and install the tapping sleeves and valves to existing reclaimed water transmission mains.
- D. The contractor shall pressure test the tapping sleeve and valve installation in the presence of the City of Richmond Hill Inspections Department. The test pressure shall be 150 psi. This shall be held for ten minutes at zero pressure loss.
- E. Valves on existing mains shall be operated by the City of Richmond Hill or under their direct supervision.
- F. When service must be interrupted to existing customers during construction of a tap or addition of appurtenances: The contractor shall provide 3 days notice to the City of Richmond Hill Inspections Department. The contractor or developer shall be required to notify existing customers as directed by the City of Richmond Hill. The contractor shall be ready to proceed with as much material preassembled as possible at the site to minimize the length of service interruption. The City of Richmond Hill will postpone a service cut-off if the contractor is not ready to proceed on schedule.

Section 1306 Urban Reuse System Details

(1.) Residential Reclaimed Water Connection	RW 1
(2.) Typical Service Connection ¾" – 2"	RW 1.1a & RW 1.1b
(3.) Typical Double Service Connection ¾" – 2"	RW 2
(4.) 3" Meter Service	RW 3a & RW 3b
(5.) 4" Meter Service	RW 4a & RW 4b
(6.) 6" Meter Service	RW 5a & RW 5b
(7.) Typical Gate Valve Setting and Main Cut-In	RW 6
(8.) Typical Butterfly Valve Setting	RW 7
(9.) Reclaimed Water Pipe Separation	RW 8a & RW 8b
(10.) Pressure Pipe Conflict	RW 9a & RW 9b
(11.) Casing Installation	RW 10
(12.) Typical Trench Root Barrier Installation	RW 11
(13.) Typical Utilities Canal Crossing	RW 12a & RW 12b
(14.) Fan Guard / Pipe Cap Design	RW 13
(15.) Underground Air Release Valve & Vault in Non-Traffic Areas Outside Of Road Right-Of-Way	RW 14
(16.) Air Release Valve And Manhole In Paved Area And Road Right-Of-Way	RW 15
(17.) Pressure Test Criteria	RW 16
(18.) Off-Set Underground Air Release Valve	RW 17a & RW 17b
(19.) Pipe Installation Under Existing Pavement - Open Cut	RW 18
(20.) Reclaimed Water Standard Sign	RW 19

ARTICLE 14

ENVIRONMENTAL SITE ASSESSMENTS

When required by the Subdivision Regulations, an Environmental Site Assessment (ESA) shall be prepared by an Engineer, state licensed geologist, or other state licensed professional experienced in geo-technical investigations and the assessment of real property for environmental concerns. The ESA shall meet the minimum requirements of ASTM 1527 "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." The ESA shall consist of a record review of records, site reconnaissance, interview, and report. The following guidelines shall be used in the preparation of the ESA.

Section 1400 The Record Review Portion of the ESA shall Consist of the following:

- (1) Review available site plans, surveys, current and historical aerial photos. Consider adjacent property and its current use.
- (2) Review available real estate and topographical maps, geologic information, and hydrological data for the site and vicinity.
- (3) Review published surface and subsurface information for the site vicinity, including previous geo-technical boring logs, well logs, utility plans, and site zoning. Consider geologic data regarding to the potential for naturally occurring methane gas.
- (4) Review Records of the County Clerk's Office to identify site ownership for at least fifty (50) years and to identify prior uses of the site and adjacent properties, where possible.
- (5) Identify and locate, within one (1) mile of the proposed development: Any National Priority List Superfund Cleanup Sites, any facilities engaged in the treatment, storage, or disposal of hazardous wastes, and any disposal sites that have been identified in the City or County.
- (6) Access public records to obtain information about the site's regulatory history as revealed by permits issued, citations from local, state, or federal agencies.
- (7) Interview appropriate public officials with respect to waste disposal at or in the vicinity of the site; make inquiries to determine if there may be any records about underground tanks.
- (8) When possible, interview parties who may be familiar with past uses of the site or adjacent sites.

Section 1401 The Site Reconnaissance Portion of the ESA shall consist of the following:

- (1) Walk over the site and view it also from adjacent public right-of-way.
- (2) Note and record information about the locations and sizes of structures, if any, evidence of any below-grade tanks, distressed vegetation, signs of chemical production or storage, the nature of any trash or rubble on site, the types of businesses and activities operating in the area, and evidence of any illegal disposal practices.
- (3) Note and record appropriate information gained by observing adjacent sites, from conversations with site personnel, or from other sources.

Section 1402 The Interview Portion of the ESA shall consist of the following

- (1) Interview owners and occupants of the property.
- (2) Interview local government officials.
- (3) Interviews with adjacent property owners.

Section 1403 The Report Portion of the ESA shall consist of the following

- (1) After the completion of the historical review, site reconnaissance, and soil borings; the findings required in the previous subsections shall be prepared and included in the ESA report to the City Engineer for his review and approval.
- (2) The ESA report shall document each source that was used, even if a source revealed no finding. Sources shall be sufficiently documented, including name, date request for information was filled, date information provided was last updated by source, date information was last updated by original source so as to facilitate reconstruction of the research at a later date.
- (3) The ESA report shall contain a statement of the opinion of the individual responsible for the report as to the suitability of the site for the proposed development.
- (4) The ESA must be submitted to and approved by the City Engineer prior to approval of construction plans.

If, in the opinion of the individual responsible for preparing the ESA, it would be necessary to develop additional information by the use of soil borings, then the ESA report shall include the results of the soil borings.

If the soil borings reveal a potential problem, then additional subsurface exploration and chemical testing will be required as determined by the City Engineer.

ARTICLE 15

CONSTRUCTION APPROVALS AND ACCEPTANCE

Section 1500 General

- (1) The City has the right to require changes in the work that are not in accordance with the Engineering Standards or the approved construction plans and which would, in the opinion of the City Engineer, negatively impact the ability of the City to provide normal maintenance in the City right-of-way.
- (2) Any work rejected by the City's Inspections Department shall be removed and reworked to the satisfaction of such Department.
- (3) The City's Inspections Department shall have the right to require any work be uncovered. If defective work is suspected or to correct defects discovered during inspection, the City's Inspections Department may require testing of such work.

Section 1501 Applicant's Engineer's Responsibility

- (1) Applicant's Engineer will review all phases of the work in progress and will be responsible for ascertaining whether or not the work is performed in accordance with Applicant's plans and specifications and the City's requirements.
- (2) Applicant's Engineer shall promptly furnish the City Engineer with pertinent information concerning changes made during the progress of the work. No changes shall be performed without the prior approval of the City Engineer or his field representative.

Section 1502 Construction Inspection

- (1) The City of Richmond Hill Inspections Department shall be given at least twenty four (24) hours notice prior to the need for all road construction inspections.
- (2) Proof-rolling of the sub-grade base shall be preformed in the presence of a representative of the City's Inspections Department, the Design Engineer and the Contractor. Any unsatisfactory areas shall be corrected to the satisfaction of the City's Inspections Department prior to proceeding with the next pavement course. Proof rolling shall be done as follows: a loaded tandem dump truck shall make two passes over the area to be tested while a representative of the City's Inspection Department is present. On the third pass the representative of the City's Inspection Department, Design Engineer and Contractor will walk behind the dump truck and observe for any unsatisfactory areas.
- (3) Prior to backfill of any cross-drain pipe, the installation shall be inspected and approved by the City's Inspections Department.

- (4) When requested by the City's Inspection Department, pavement design reports prepared by an independent laboratory shall be submitted to them for approval prior to paving.
- (5) Laboratory compaction, stability and density testing is required for pavement. Compressive strength testing is required for concrete curb and gutter. Pavement core sample reports are required at three hundred (300) feet spacing to show thickness of bases and surface. Reports shall include a map showing core locations. Additional pavement core samples may be required if the City's Inspection Department considers it necessary. Sub-grade and base material laboratory compaction testing shall be required at three hundred (300) feet (more testing locations may be required if the City Inspections Department considers it is necessary). Reports shall include a map showing testing locations. 100% compaction is required for sub base and base material.
- (6) All test results must be submitted to the City of Richmond Hill Inspections Department prior to proceeding with the next sequence of construction. Specifically, compaction results must be submitted and approved prior to placement of curb and gutter, all sub-grade test results prior to placement of base material, and base thickness and compaction results prior to asphalt surface pour.
- (7) If any of the above tests show substandard conditions, then additional tests may be required by the City's Inspection Department to reveal the extent and cause of the substandard condition. All tests shall be preformed by a qualified independent testing laboratory approved by the City Engineer.
- (8) A proposed plan to correct substandard conditions shall be submitted by Applicant's Engineer for approval by the City Engineer prior to beginning work.
- (9) Each of the following items that need to be inspected shall pass inspection before the next step in construction shall take place:
 - *1. Pre-development testing of twenty four (24) inches of sub-grade material directly under proposed curb and gutter, base and pavement areas to see if the existing material is suitable for curb and roads. See Article 8 pavement design.
 - *2. Curb and gutter area compaction test. One hundred (100%) percent compaction, standard proctor, required.
 - **3. Curb and gutter area material testing. A bore is done on the twenty four (24) inches of material that will be directly under the curb and gutter to make sure the material is suitable.
 4. Curb and gutter area proof roll with a loaded tandem dump truck.

- *5. Roadway sub-grade compaction test. One hundred (100%) percent Compaction, standard proctor, required.
- **6. Roadway sub-grade area material testing. A bore is done on the twenty four (24) inches of material that will be directly under the base and paving to make sure the material is suitable.
- 7. Roadway sub-grade proof roll with a loaded tandem dump truck.
- *8. Roadway base compaction test. One hundred (100%) percent compaction, standard proctor, required.
- *9. Roadway base bore test to check thickness of base material.
- 10. Roadway base proof roll with a loaded tandem dump truck.
- 11. Roadway visual check before asphalt paving is put down.
- *12. Asphalt pavement core test to check thickness of asphalt.
- 13. Storm sewer lamp and mirror test. (see # 21)
- 14. Water pressure and leakage test. One hundred fifty (150) PSI for two (2) hours.
- *15. Water sample test.
- 16. Fire hydrant flow rate test (G.P.M.)
- 17. Force main pressure test. One hundred (100) PSI for two (2) hours.
- 18. Sanitary sewer mandrel test. Five (5%) percent deflection.
- 19. Sanitary sewer lamp and mirror test.
- 20. Sanitary sewer lateral tennis ball drop test.(curb and stone base in place)
- **21. Sanitary sewer video and storm sewer video.
- 22. Sanitary sewer lift station inspection.

23. A final inspection will be scheduled after certification is received from the Applicant's Engineer confirming that the improvements have been built in accordance with the approved plans and specifications. Record Drawings or as built will have to be submitted before a final inspection will be approved.

Notes:

- * Test done by a certified laboratory recognized by the City of Richmond Hill.
- ** Test done by a certified laboratory, recognized by the City of Richmond Hill, if the City of Richmond Hill Inspections Department considers it necessary to insure that adequate work has been done.

Also:

1. #1 required inspection can be disregarded if all areas, twenty four (24) inches below proposed curb and gutter and base and paving areas, are agreed to be mucked out and backfilled with suitable material. (See Article 8 pavement design).
2. Notify the City of Richmond Hill Inspections Department no less than forty eight (48) hours before any excavations in city right of ways take place. A right of way permit is required to work in any City of Richmond Hill right of way.
3. All road crossings shall be inspected by a representative of the City's Inspection Department before cover is applied.
4. All tie into existing utilities shall be done in the presence of the City of Richmond Hill Inspections Department.
5. Sanitary sewer has to be in place a minimum of 30 days and all road mucking and backfilling complete before being inspected.

Section 1503 Criteria for Requiring Replacement of Curb and Gutter

- (1) Improper contraction joints.
- (2) “Y” cracks.
- (3) Spalling cracks.
- (4) Off-grade or misaligned sections.
- (5) Any crack within two (2) feet of an expansion or construction joint (remove half, with saw cut joint).
- (6) Two or more cracks of any size within ten (10) feet.
- (7) Failure to meet strength or location specifications.
- (8) If any crack exceeds 1/8” in width.

Section 1504 Construction Failures

City approval of the constructed improvements shall not relieve the Developer of responsibility for construction failures. The Developer shall repair any failure or deficiencies that occur during the warranty period.

Section 1505 Record Drawings

(As used herein, Record Drawings mean the Construction Plans as modified to reflect field changes.)

Three inked copies of the Record Drawings on 24”x36” sheets shall be delivered to the City of Richmond Hill Inspections Department prior to approval of the final inspection. Three complete digital Record Drawings are also required. The three year maintenance period cannot begin until record drawings have been received and a final inspection has been performed and approved by the City’s Inspection Department. Additionally, an AUTOCAD Drawing file and DXF on 3 1/2 diskette shall be delivered to the City of Richmond Hill Inspections Department. The Record Drawings shall contain the following information:

- (1) Drainage:
 - (a) As built manhole invert, inlets, pipe inverts, frames, headwall, and end treatments elevations (MSL).
 - (b) As built length, grade, diameter, pipe material between structures, manholes, inlets and end treatments.
 - (c) Locations of structures, headwall, manholes, inlets, and end treatments in relation to right-of-way lines, property lines, and other permanent structures.
 - (d) As built locations of lines, slope, width, and depth of ditches, swales, canals, and drainage basins.

- (2) Pavement:
 - (a) Edge of pavement where it differs more than two (2) feet from approved plan.
 - (b) Pavement profiles where grade of installed paving differs more than 0.1% from proposed grades.
 - (c) Areas where conditions require alternative bases or sub-grade material or treatment.
- (3) Water: Domestic and Reuse
 - (a) As built location of water mains, depth, grade, and diameters.
 - (b) As built locations of valves, blow-offs, fire hydrants locations in relation to property lines, road intersections and other permanent structures.
 - (c) As built locations of all service laterals. Measurements shall be from permanent structures and shall indicate the location of the connection at the main and the location at the property line.
- (4) Sanitary Sewer:
 - (a) As built manhole invert elevations (MSL), invert elevations of all mains at the manhole and elevations of all manhole tops.
 - (b) Lateral locations measured from the down stream manhole at the main. Measurements shall be from permanent structures and shall indicate the location of the connection at the main and the location at the property line.
 - (c) As built length, grades, size and type of material between manholes.
 - (d) Locations of manholes in relation to the right-of-way lines, property lines, and other permanent structures.

(5) Other:

Locations of all special construction requirements in addition to the above such as sheeting left in place, concrete cradles, concrete encasement, end of casings, and section of casing and carrier pipe depicting the material and installation requirement if different from the approved plan.

Section 1506 Request for Inspections

The warranty period for all projects to be dedicated to the City of Richmond Hill for maintenance is three (3) years. After a final inspection has been completed by the City's Inspection Department and all items approved the three (3) year warranty period will begin. After each year, the Developer's Engineer must submit to the City's Planning and Zoning Director a written request to inspect the project's improvements dedicated to the City of Richmond Hill in order to obtain a release of that portion from the instrument securing the warranty. Any deficiencies found at that time must be corrected, inspected and approved by the City's Inspections Department.

Section 1507 Recommendation for Acceptance

The Director of Planning and Zoning will provide to the City Council a report on any subdivision improvements dedicated to the City. The report will indicate whether the work is acceptable. If the work is acceptable to the City, the Director of Planning and Zoning will recommend that the warranty be released. If the report indicates that the work is unacceptable, the City Engineer shall make an estimate of the cost to make the work acceptable. The City Council will determine whether or not to release the warranty.

Section 1508 Developer's Certification of Non-Litigation

Prior to City acceptance of subdivision improvements for maintenance, the developer shall certify that there are no pending or threatened actions of law that involve the subdivision improvements, including any liens from contractors, sub-contractors, suppliers of material and equipment, and all providers of labor or services associated with the subdivision improvements. If any such actions of law or liens remain unresolved, the City will not accept the subdivision improvements for maintenance until releases or waivers are provided.

ARTICLE 16

LEGAL STATUS PROVISIONS

Section 1600 Interpretation

The regulations expressed in the Engineering Standards shall be considered as the minimum provisions for the protection of the health, safety, economy, good order, appearance, convenience and welfare of the general public.

Section 1601 Severability

Should any section or provision of the Engineering Standards be declared by a Court to be unconstitutional or invalid, such declaration shall not affect the Engineering Standards as a whole, or any other part thereof, other than the part so declared to be unconstitutional or invalid.

Section 1602 Effective Date

The Engineering Standards shall take effect on and after March 3, 2015.

Section 1603 Repeal of Conflicting Ordinances

All ordinances or parts of ordinances in conflict herewith are hereby repealed.

Section 1604 Conflicts

In the event of a conflict between a provision of the Engineering Standards and a provision of the Subdivision Regulations, the provision in the Subdivision Regulations shall control.

Section 1605 Jurisdiction

The jurisdiction of the Engineering Standards shall be all the incorporated areas within the limits of the City of Richmond Hill, Georgia and all infrastructure outside the incorporated areas that are to be dedicated to the City of Richmond Hill.

Section 1606 Attachments

The Sample Engineering and Inspections Services letter, Sample Certification of Non-Litigation, Sanitary and Storm Sewer Invert Elevation Certification, Design Engineer Improvements Certification and the attached drawings and details are all made a part of the Engineering Standards by specific reference. In the event of a conflict between the text of the Engineering Standards and any of such drawings or details, the text shall control.

SAMPLE ENGINEERING INSPECTION SERVICES LETTER
(On Engineer's Letterhead)

City of Richmond Hill
Director of Planning and Zoning
P.O. Box 250
Richmond Hill, Georgia 31324

Re: (Name of Subdivision)

Dear Sir:

This letter shall certify that I have been retained by (name of the developer) to provide construction inspection services for the referenced subdivision development. The scope of the inspection services to be provided conforms with those stipulated in the Richmond Hill Engineering Design Standards.

Furthermore, I agree that if at any time prior to City acceptance of subdivision improvements in the subdivision for maintenance, my construction inspection services are discontinued for any reason, I will notify you in writing immediately.

Engineer: _____
Print/Signature

Date: _____ (GA P.E. Seal)

Developer/Owner: _____
Print/Signature

Date: _____

SAMPLE CERTIFICATION OF NON-LITIGATION

CERTIFICATE OF NON-LITIGATION

I (We) hereby swear that there are no pending or threatened actions of law that will affect the dedication of the subdivision improvements in the below named project to Richmond Hill. I (We) further swear that all attorneys, engineers, surveyors, contractors, sub-contractors, material suppliers, equipment suppliers, or other persons, firms or corporations retained for the purpose of designing, planning and constructing the project have been paid in full.

Project Description:

Sworn to and subscribed
before me this _____ day
of _____, _____.

Developer

Notary Public

Engineer

APPENDIX A

ENGINEERING DETAILS